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Theorists have shown how credit enhancement in the generic form of collateral can mitigate market failures in credit markets. None of these models has explained, however, why a personal guarantee rather than collateral will appear in the equilibrium debt contract. In the first essay, I develop optimal debt contracting models under moral hazard to show that lower transactions costs associated with guarantees make them more efficient than collateral. The guarantee contract is feasible, however, only if the business owner is sufficiently wealthy relative to the loan amount. This result suggests that market failure may occur if a small business owner with a high-return project has inadequate personal wealth to guarantee a loan.

The second essay in this dissertation uses data from the 2003 Survey of Small Business Finances to empirically test the predictions of the first essay. I estimate both multinomial logit and ordered probit models to examine the effect of guarantor wealth on the equilibrium enhancement structure for lines of credit. I find that increasing owner wealth results in an increased likelihood that a line of credit will be enhanced with only a personal guarantee and a decreased likelihood that the line of credit will be secured with collateral. I also find that use of the more efficient guarantee is less prevalent when the borrower is located in a non-competitive banking market. Both results are consistent with predictions of the first essay.

Relationships between small businesses and financial intermediaries are generally viewed only as mechanisms that arise to mitigate informational asymmetries in credit markets. In the third essay, I use a pooled cross section of the 1988, 1993, 1998 and 2003 Surveys of Small Business Finances to study relationships between small businesses and their primary source of financial services. I find evidence that mechanisms other than mitigation of informational asymmetries in credit transactions influence the structure and benefits associated with maintaining relationships. I also find that the two empirical measures of relationship strength decreased between 1988 and 2003 as the small business credit market was being transformed by bank consolidation, financial deregulation and technological innovation in small business lending.

THREE ESSAYS IN ENTREPRENEURIAL FINANCIAL MARKETS

by

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APPROVAL PAGE

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CHAPTER I

ESSAY 1 - CREDIT ENHANCEMENT: COLLATERAL, GUARANTEES, AND THE ROLE OF OWNER WEALTH

Abstract

Credit enhancements in the form of collateral or personal guarantees are widely used contractual features in small business credit contracts. While both of these forms of credit enhancement serve to alter the distribution of returns in the event of default, they may differ in both their relative transactions costs and potential repayment values. These differences have not previously been formalized or addressed in the theoretical literature on credit contracting. I develop debt contracting models under moral hazard for both collateral and personal guarantees. A comparison of the two contracts shows that, if guarantor wealth is sufficiently large relative to the loan amount, the more efficient guarantee contract becomes Pareto improving. The models also show why both forms of enhancement, collateral and guarantee, might appear in the equilibrium credit contract at lower levels of owner wealth. This result suggests that the personal wealth of the small business owner plays a larger role in the allocation of credit in the small business credit markets than has been indicated by previous research. The result also suggests that policy, such as public loan guarantees, could improve the allocation of capital by securing funding for wealth-constrained entrepreneurs who have high net present value project opportunities.

Introduction

Large firms that access public markets for equity and debt financing employ public accounting firms, investor relations professionals, and treasury departments to generate and disseminate credible information which investors, analysts and rating agencies use to access and communicate the firm's financial prospects and risks. In contrast, small private firms must raise funds from financial intermediaries in an environment of informational opacity in which information on cash flows, financial valuations, and management abilities are private and knowable only at a considerable cost to the lender and even then with considerable uncertainty. In this environment, a range of tools are available to facilitate debt contracting. These tools are collectively called credit enhancements. Credit enhancement mechanisms can improve the efficiency of the capital market by reducing the costs to borrowers of external debt. They do so by efficiently mitigating the informational problems which outside creditors face when financing a project. The most common forms of credit enhancement are collateral, where a loan is secured by a pledge of specific business or personal assets, and personal guarantees, where security takes the form of a general claim on the borrower's personal wealth.

This essay examines the differences between securing a loan with collateral or a personal guarantee when there is a positive probability the borrower will default. This essay shows, under conditions of moral hazard and a competitive credit market, that a personal guarantee will emerge as the efficient, and therefore the equilibrium, form of credit enhancement when the business owner-guarantor has sufficient outside wealth. The

models developed here to compare collateral and personal guarantees also show that equilibrium contracts employing both forms of credit enhancement could emerge at intermediate levels of guarantor wealth.

Berger and Udell (2003) categorize a personal guarantee as a distinct and “important contracting tool in small business lending” that is “similar to pledges of personal assets (as opposed to business assets) but with important differences.” These differences have not, however, been systemically addressed by the debt contracting literature. The theoretical literature on credit enhancement either ignores the use of personal guarantees or treats them as perfect substitutes for collateral, and therefore, equivalent to them. With a few recent exceptions, the empirical literature has also ignored the existence of guarantees or treated them as an undifferentiated form of collateral. As a consequence, we know little about the circumstances under which personal guarantees emerge as the optimal form of credit enhancement. Similarly, we know little about the circumstances under which both collateral and personal guarantees appear in the equilibrium debt contract. This gap in our knowledge persists despite the ubiquitous and growing use of guarantees in the US small business credit market.

This essay contributes to the current literature in two ways. First, I clarify the salient differences between collateral and personal guarantees and how they should appear in theoretical models of credit enhancement. In particular, I explicitly model and differentiate all of the transactions costs which are associated with the use of collateral and personal guarantees. Secondly, I use this framework to develop a credit contracting model in which the deadweight social costs generated by using personal guarantees

decrease with the borrower's wealth. The deadweight costs of using collateral, in contrast, are independent of the borrower's wealth. As a result, entrepreneurs will be offered and will accept credit contracts in a competitive credit market which uses personal guarantees as credit enhancements when the entrepreneur's wealth is great enough to support the guarantee. The model generates several specific testable hypotheses about the use of guarantees and collateral which are examined in the second essay of this dissertation.

The remainder of the essay is organized as follows. *The Use of Credit Enhancement in Debt Contracting* develops the notion of alternative credit enhancement structures and differences between collateral and personal guarantees. *Review of the Literature on Collateral Theory* summarizes the theoretical literature on collateral. In *A Collateral Model with Moral Hazard*, I employ a simple loan contracting model in an environment of moral hazard to demonstrate transactions costs of collateral and its role in improving efficiency in the small business credit market. *Modifying the Collateral Model for Guarantee Attributes and Owner Wealth* extends the model for the case of a personal guarantee and explicitly summarizes the implications of the model for credit enhancement structure as owner wealth increases. *The Relative Efficiency of Guarantees and Collateral* develops the conditions under which a personal guarantee rather than collateral will emerge as the equilibrium form of credit enhancement. *Extensions of the Basic Model* shows how both collateral and a personal guarantee might appear in the equilibrium loan contract and analyzes the effect of a monopolistic credit market on the optimal contract. The section also examines extensions of the model to situations where

both guarantees and collateral might be used and the choice between the two when credit markets are not competitive. *Summary and Implications* summarizes the results of the analysis, identifies its empirical predictions, and discusses its implications for public policy.

The Use of Credit Enhancement in Debt Contracting

Were the credit market for small to medium sized enterprises (SME) complete, information regarding their financial condition and future prospects available in the public domain, and action choices of their management observable, all investments with positive net present values would be financed at a rate equal to the risk-free interest rate plus a borrower-state specific risk premium. In this ideal Arrow-Debreu world, financing contracts, given amount and maturity, would be written in the dimension of state specific interest rates and directly placed with investors. Credit enhancement in the form of collateral and/or personal guarantees of the owner(s) would have no role in improving the efficiency of credit markets. Further, in view of the deadweight costs associated with its use, credit enhancement would be not only unnecessary, but inefficient.

However, credit markets involving SMEs are characterized by market imperfections in the form of informational asymmetries (moral hazard and adverse selection) and transactions costs. SMEs are by definition small, and in practice, are highly opaque private businesses. Potential lenders in this market face several substantial informational obstacles. Prior to making a loan, the potential lender must assess the likelihood of full and timely repayment of the loan. In the literature, this process is referred to as “screening” and involves obtaining and processing information regarding

the borrower's business, finances, managerial capability, past performance, reputation, competitors, market position, investment plans, etc. The goal of this process can be viewed as estimating the probability the borrower will repay the loan principle and interest when due from its normal operations. The process is similar to that performed by rating agencies for the publicly traded debt obligations of larger businesses. In the case of SMEs however, each potential lender must obtain and process the private information of the borrower. This screening process is time consuming and costly.¹ Credit contracts containing credit enhancement requirements as well as an interest rate can improve the efficiency of screening both by mitigating adverse selection and by providing lenders with an alternative source of repayment should the borrowing firm's cash flows from operations be insufficient to repay its loan.²

The second form of informational problem, moral hazard, arises once the loan is made. Moral hazard in the SME credit market can take three distinct forms: the assumption of additional business risk by the borrower after the contract has been signed, a hidden diversion of assets from the business to the business owner before repayment is made, and a hidden choice by the borrower of a suboptimal level of effort. The incentives to engage in these behaviors arise from the overlap of managerial and ownership roles which are typical in small businesses and which confound the firm's profit and the owner's utility. These incentives can be affected by the terms of the loan contract, and generally increase with the interest rate and other loan costs. Credit

¹ Berger and Udell (2005) provide a comprehensive overview of the different lending technologies used by financial intermediaries to screen loan requests for small businesses.

² This role of collateral is studied by Manove, Padilla, and Pagano (2001) who develop the "Lazy Bank Hypothesis" under which banks inefficiently substitute collateral for screening and monitoring.

enhancement, in contrast, is a mechanism to mitigate moral hazard by providing offsetting the manager/owner's perverse incentives.³ As a result, credit enhancement reduces the need for the lender to engage in expensive monitoring of the borrower's activities. In doing so, it makes it feasible for an external investor to rely on a simple debt contract, as opposed to equity, which specifies outcomes in only two possible states of the world — when the borrower pays as the contract specifies or upon default.

Figure 1.1 provides a schematic of the steps in the credit contracting process when credit enhancement is included as a term in the credit contract. In this simple model, the entrepreneur borrows L to finance a project that yields a gross return of R . The loan calls for a repayment equal to $L(1+i)$, where i is the interest rate charged on the loan. Once the contract is signed the borrower operates the project and makes choices which affect its outcome and the lender can only observe by performing costly monitoring. At the end of the project the borrower repays the loan in full when $R \geq L(1+i)$ or, if R is lower, gives the lender all of R and makes up the deficit out of the liquidated collateral or, under a guarantee, the liquidated personal wealth.

The impact of credit enhancement on the credit contract can be illustrated by looking at the lender's expected profit: $E[\Pi] = [p_s L(1+i) + (1-p_s) * EV] - L(1+r)$ where p_s is the probability of repayment through firm operations, L is the loan principle, i is the loan interest rate, r is the lender's marginal cost of funds and EV is the liquidation value of the credit enhancement. In a competitive credit market, which we assume for

³ Coco (2000) provides a survey of the literature on collateral.

most of this essay, $E[\Pi]=0$, and credit enhancement increases the lender's return when $R < EV$ in the default state when $EV > R$. To maintain a zero expected profit, the contract must also call for a lower gross interest $(1+i)$, thus a lower cost of capital. As we see below, credit enhancement also provides the entrepreneur with incentives to provide more effort which increases p_s . The increase in the probability of full repayment also increases the lender's expected profit, and so competition requires a further decrease in the interest rate charged to the borrower. Therefore, credit enhancement lowers interest costs to borrowers in the small business loan market by simultaneously increasing the probability of full repayment as well as the amount repaid if default occurs.

Because credit enhancement can reduce the cost of capital and mitigate moral hazard, it is not surprising it is widely used in small business loan contracts. The primary forms credit enhancement takes, moreover, are collateral and personal guarantees. Table 1.1 illustrates this generalization using information about more than 1300 contracts for lines of credit taken out by small businesses in 2003.⁴ Three-quarters of these firms, all of who operated under limited liability rules, used some form of credit enhancement to secure their loans — which underscores the pervasiveness of these mechanisms at least within this one very important market.⁵ I am more concerned here however, with the type of enhancement that was used — 44 percent of the enhancements took the form of personal guarantees, while only 20 percent used collateral. The remaining lines of credit

⁴ The information in Table 1.1 was extracted from the public use form of the Federal Reserve Board's 2003 Survey of Small Business Finance.

⁵ Further evidence can be found in Leeth and Scott (1989) who report that over 60 percent of small business loans in the 1980 and 1982 National Federation of Business surveys were collateralized and Berger and Udell (1990) who report that 70 percent of US commercial and industrial loans were secured.

which were enhanced used both a guarantee and collateral. Although the literature has recognized and explained the role credit enhancement plays in general, it has yet to confront the choice of using collateral or personal guarantees for this purpose.

Differences Between Collateral and Guarantees as Credit Enhancements

Despite their pervasive use as a form of credit enhancement in the SME credit market, little has been said about guarantees in the theoretical literature on credit enhancement. Mann (1997) does specifically identify personal guarantees of the owner-manager as a “particularly effective tool for limiting the borrower’s risk preference incentives... by enhancing the likelihood that the principal will feel any losses personally.”⁶ In their chapter on small business and debt finance, Berger and Udell (2000) write that “personal guarantees are an important contracting tool in small business lending.” They further describe guarantees as similar to outside collateral with “three important exceptions.” The exceptions identified are: 1) a guarantee conveys a claim against the entire net worth of the guarantor rather than a claim only against the specific assets serving as collateral; 2) a guarantee imposes no constraint on the use or disposition of personal assets, as is the case with assets pledged as collateral; and 3) legislative provisions such as homestead exemptions under state personal bankruptcy law may limit access to some forms of guarantor wealth when the lender attempts to collect under a

⁶ Mann’s 1997 article in the Georgetown Legal Journal on the role of Collateral in Small Business lending is referred to by a sizable portion of the empirical literature.

guarantee.⁷ While these characterizations are generally accurate, a more complete and specific discussion is required to identify the differences between collateral and guarantees that determine the conditions under which one form of enhancement is preferred to the other.

Collateral involves the legal pledging or granting of a security interest in a specific asset (or assets) to the lender. In the event of borrower default, the lender may take action to convert its contingent claim on the designated asset(s) into outright ownership and sell the asset in settlement of its claim on the borrower. The amount received by the lender in liquidation depends on the market for the specific asset at the time of default and liquidation, the efficacy of the lender in disposing of assets with, generally, limited liquidity, and the costs of marketing and selling the asset. The current conditions in the residential and commercial real estate markets provide an extreme example of the potential for erosion of the market value for assets serving as collateral and for the liquidity risks associated with collateral.

Depending on the specific type of asset pledged (e.g. real property, titled vehicles, equipment, inventory, or accounts receivable), security interests are recorded through mortgage or deed of trust recordings, title registrations, Uniform Commercial Code (UCC) filings, or even possession by the lender. The costs of perfecting the lender's security interest in pledged assets are generally non-trivial and often significant.

⁷ This latter limitation would not pertain to collateral supported by a perfected security interest.

Furthermore, since they are incurred ex-ante, these transaction costs are incurred whether or not default and collateral liquidation subsequently take place. Similarly, lender monitoring costs and borrower utility losses from use and disposal restrictions placed on pledged assets are incurred prior to any need to rely on collateral liquidation for repayment. Though the lender is granted contingent property rights to specific assets, the lender's liquidation value depends on the market value of the collateral at the time of liquidation less transactions costs incurred in transferring ownership to the lender and in the subsequent sale of the collateral. These collateral liquidation costs can be substantial. The literature has generally held that the collateral liquidation costs incurred by lenders exceed those which would be incurred if the assets were liquidated in the normal course of business by the asset owner. To summarize, collateral is costly to implement and maintain, these costs are incurred whether or not there is a default which results in liquidation of the collateral, and the amount realized in liquidation may be less than the borrower's unpaid debt.

More recently the literature has begun to differentiate between "inside" (business owned) collateral and "outside" (personally owned) collateral. Inside collateral consists of assets owned and pledged by the borrowing business firm. In the event of bankruptcy of a limited liability business, inside collateral orders the priority of payments to creditors from the liquidation of firm assets. Inside collateral does not augment firm resources for affecting creditor payments. Outside collateral consists of assets owned not by the borrowing firm, but by a third party. In the small business market, this third party is almost invariably the firm's owner(s). Outside collateral augments the potential

resources available for creditor repayment in cases where firm resources alone are insufficient to affect full repayment in liquidation.

This distinction between inside and outside collateral is, generally, an implicit one in the theoretical literature. The empirical literature on collateral has only recently begun to differentiate between inside and outside collateral. In the case of SMEs, which are overwhelmingly owned by individuals or families, the distinction between collateralizing with firm-owned versus personally owned assets may be less important. The concentrated ownership of these firms has the ability to divert unpledged business assets to either personal use or to personal ownership.

Guarantees do not convey a claim against specific assets. Rather, they represent a contingent claim against the guarantor's net worth. The claim is contingent on the borrower's default on the guaranteed loan. Should the borrower default, the guaranteed lender has an unsecured claim against the guarantor. Guarantees are generally written for an unlimited amount or for a specific amount corresponding to the amount of the loan. In either case the potential amount of the contingent claim is limited to the loan amount.⁸

In the event of business default, the repayment value of the guarantee to the lender is the lesser of the amount owed to the bank or the guarantor's net worth less transaction costs incurred by the guarantor in converting assets into liquid form. Thus, the outside net worth of the guarantor at the time of default is positively associated with the lender's return should the borrower fail. Guarantees are an "outside" form of credit enhancement for debts of firms organized with limited liability. Debts of firms organized

⁸ There is frequently a provision which extends the guarantee to cover accrued interest and collection expenses in addition to the unpaid balance on the defaulted loan.

without limited liability (i.e. proprietorships and general partnerships) are implicitly guaranteed by their owners or general partners.

Transactions costs and utility losses associated with the execution and maintenance of guarantees are negligible and, importantly, considerably less than those incurred with collateral. With no recording fees and no third party appraisals, the ex-ante cost to execute a guarantee is proximately zero. The cost of monitoring the guarantee during the term of the loan is similarly negligible. Further, with no requirement to pledge or otherwise encumber assets, a guarantee does not engender any utility loss to the business owner from diminished dominion over the assets which comprise his wealth. Finally, in the event of business default, the costs associated with asset liquidation to make payment under a guarantee are incurred by the guarantor. A wealthy guarantor can choose those assets with the lowest liquidation costs should he have to perform under his contingent obligation. This ability of the guarantor to select assets to liquidate is in direct contrast to the situation faced by a secured lender and can be expected to yield lower proportionate liquidation costs under a guarantee than under collateralization in the event of business failure.

As forms of credit enhancement, collateral and guarantees differ in two fundamental ways. The first is structural, collateral is asset specific but dollar uncertain, while a guarantee is asset uncertain but nominally dollar specific. In the event of non-payment of the loan, collateral provides the lender with the right to take possession and liquidate a specific asset (or specific assets). The lender's dollar repayment value from

the collateral depends on the market price for that asset at the time of liquidation less transactions costs associated with “foreclosure” and sale of the asset by the secured lender. In contrast, a guarantee represents a non-specific, contingent claim on the guarantor’s general net worth. It is the guarantor who chooses which assets to liquidate to meet obligations under the guarantee. A guarantee is nominally dollar specific. It may be written for a specific dollar amount, usually the loan amount, or for an “unlimited” amount.⁹ In either case, the actual repayment value of the guarantee will be less than its nominal amount if the guarantor has insufficient wealth to make full payment under the guarantee at the time of default.

The second, and very important, difference between collateral and a guarantee is the amount of dissipative costs associated with their use and when these costs are incurred. In this context, dissipative costs are dead-weight efficiency losses which arise from transactions costs or utility losses associated with the implementation of credit enhancements.¹⁰ As discussed above, the transactions costs and utility losses associated with collateral are strictly positive and can be substantial. In the case of guarantees, these dissipative costs are absent or negligible. Additionally, transactions costs associated with a guarantee are only incurred in cases where the business defaults, while the costs of obtaining and perfecting security interests in collateral are incurred without regard to subsequent business performance. These differences have not previously been

⁹ The repayment value of an “unlimited” guarantee is limited to the amount owed at the time of default.

¹⁰ In keeping with the extant theoretic debt contracting literature, I abstract from issues of non-optimal risk sharing by assuming that both the borrower and lender are risk neutral.

formalized or addressed in the theoretical literature on credit contracting which focuses on the use of collateral.

Review of the Literature on Collateral Theory

Given the dissipative costs associated with its use, for collateral to appear in credit contracts in competitive SME credit markets, it must decrease the borrowers' cost of capital.¹¹ The pervasive observed use of collateral in small business loans has motivated an extensive theoretical literature which seeks to show how collateral can mitigate market failures and frictions in small business credit markets. This literature offers a wide range of models to show how collateral can provide efficiency gains in diverse modeling structures and environments. To provide some structure to this diverse literature, I have mapped these studies into four broad categories based on how collateral can improve the efficiency of credit market contracts; 1) by establishing the relative priority of claims among multiple creditors; 2) by accommodating differences in lender-borrower evaluations of project risk; 3) by overcoming informational problems associated with adverse selection; and 4) by mitigating moral hazard.

Several papers focus on the role of collateral in establishing priority among multiple creditors. These theories are most applicable to public debt issued by large firms. Large firms are more likely to contract with multiple creditors and to issue multiple layers of debt among them, than are small businesses which tend to raise all debt

¹¹ Collateral use may decrease the "infinite" cost of capital faced by some borrowers who would otherwise be rationed out of the SME credit market.

with a single intermediary.¹² Within these more complex debt structures, the order of priority under which debt holders will be repaid if the borrowing firm defaults needs to be specified within the many debt contracts so that potentially high bankruptcy costs can be lowered. Scott (1977) and Schwartz (1981) show how issuance of secured debt can reduce the ex-ante cost of capital by reducing ex post expected bankruptcy costs. Other studies in this category use an incomplete contract approach to show how the use of secured debt reduces incentives for inefficient liquidation and supports renegotiation in the face of financial distress.¹³ Finally, Smith and Warner (1979) argue the use of collateralized debt prevents borrowers from undertaking riskier projects with debt proceeds. Their argument is based on the inability of the borrower to sell assets used as collateral to finance other, riskier asset investments. The priority models implicitly deal with inside collateral and generate a positive correlation between the riskiness of the borrower and the benefits of collateralization.

A second class of models finds an efficiency improving role for collateral where the lender and borrower have differing beliefs regarding expected business returns, the probability of business success, or the variance of firm cash flows. A common feature of these models is an optimistic entrepreneur whose belief about the probability of success or expected returns exceeds those of the lender. If the lender can assess the repayment value of collateral with sufficient certainty, then credit contracts which use collateral will produce lower costs of capital than those in which interest rates alone must compensate

¹² In the 2003 Survey of Small Business Finances, approximately three quarters of small businesses that borrow have only one institutional lender.

¹³ Examples of these works include Bester (1985), Swary and Udell (1988), and Gorton and Kahn (2000).

the lender for its relatively pessimistic assessment of the probability of project success and expected project return. Chan and Kanatas (1985) provide the standard in this class of models by showing how collateral lowers the cost of capital when the lender and borrower hold disparate beliefs about the future cash flows of the project being funded.¹⁴ Other papers in this category include those of Barro (1976), who models an environment where borrowers and lenders have ex-ante disparate beliefs regarding the variance in collateral values at loan maturity, and de Meza and Southey (1996), who model an environment where new small business entrepreneurs overestimate their probabilities of success. These models deal with outside collateral, are primarily applicable to the informationally opaque SME credit markets, and generally find borrower risk and collateral use are positively related.

The majority of theoretical work, and the final two classes of models to be examined here, explain collateral as a mechanism which mitigates market failures associated with information problems in the small business credit market. As Stiglitz and Weiss (1981) show, the credit supply function in the opaque environment of SME lending is not monotonically increasing in the interest rate. As the interest rate (price of credit) increases, two forms of informational asymmetries can cause a lender's profits to fall, which in turn, causes the borrower's cost of credit to increase. The first is deterioration in the quality of the borrowers seeking a loan as a result of adverse selection — riskier borrowers enter as applicants and lower risk borrowers drop out as the market

¹⁴ This paper was the first (and only) collateral theory paper to explicitly discuss the difference between inside and outside collateral.

rate of interest increases. Moral hazard is the second information problem which is exacerbated by high interest rates. In this case, borrowers have the incentive after the loan contract has been signed to increase the project's risk, to reduce effort in the face of unfavorable states of the world, or to under report cash flows available to repay debts.

Models of adverse selection rationalize collateral use in a framework where lenders are less informed about borrowers' credit worthiness than are borrowers. Since the expected cost of collateral is higher for borrowers with higher default probabilities, willingness to pledge (outside) assets as collateral serves as a valid signal of the borrower's riskiness. Depending on the model, this positive correlation between the borrower's default probability and expected cost of collateral, leads to credit contracts in the interest rate/collateral space which produce either a separating equilibrium or a complete sorting by risk. Examples of collateral models showing how the use of collateral as a contracting variable can mitigate credit market failures caused by adverse selection include Wette (1983), Bester (1985), Chan and Kanatas (1985), Bester (1987), Besanko and Thakor (1987), Sharpe (1990), and Coco (2000). An empirical challenge faced by these adverse selection models is their conclusion that lower risk firms, for which collateral is less costly, pledge collateral and pay a low interest rate while higher risk firms pay high interest rates but pledge no collateral. This pattern of correlation between borrower risk and collateral is counter to that reported by both practitioners (Morsman, 1986) and the preponderance of empirical evidence on the correlation between borrower risk and collateral use (Steijers and Voordeckers, 2009).

Frameworks which rely on moral hazard represent the fourth, and last, broad categories of models which explain the use of collateral. This literature considers three different types of moral hazard. In each case, higher interest rates in the loan contract increase incentives for the borrower to take ex-post actions which reduce the expected return to the lender. When effort is both costly to the owner-manager and a determinant of the expected return of the business, an increase in the interest rate has two effects on the lender's expected return. The direct effect is to increase the bank's return in states of business performance where firm cash flows are sufficient to repay the debt. The indirect effect, however, is to reduce the likelihood the borrower will experience a state where cash flows can repay debt. The reduced likelihood of experiencing states where cash flows are sufficient results from the perverse effect of interest rate increases on the borrower's return to effort. Watson (1984) develops the first model showing how collateral can improve efficiency when borrower effort is endogenous. Collateral improves efficiency by increasing the marginal returns to effort in states where the borrower defaults.

Another form of moral hazard is the incentive for the borrower to undertake riskier business strategies once the credit contract has been accepted. The borrower's return from operating the business is the expected value of cash flows which exceed principal and interest payments on their debt. Increasing the interest rate on the loan reduces the support over which the borrower earns a net return. After receiving a loan to finance a given "project" with given risk and return characteristics, the borrower can increase expected return at the expense of the lender by investing in a project with a

higher return, if successful, but with a lower probability of success. Adding collateral as a term in the debt contract removes the incentive for the borrower to pursue higher risk business strategies by increasing the degree to which losses are incurred by the owner-manager rather than by the lender.

The third class of moral hazard models builds on the costly state verification models of Townsend (1978), Diamond (1984), and Gale and Hellwig (1986). The environment in these models is one in which the firm's realized return or cash flow is ex-post private information of the borrower. This framework highlights the borrower's incentive to underreport returns to the lender or, alternatively, to divert firm funds to personal use rather than to repay the lender. This incentive may be particularly applicable when firm cash flows are insufficient to meet debt repayments. To reduce borrower incentives to appropriate returns, lenders engage in costly "state verification," such as requiring audited financial statements, review of debits and credits to the borrower's demand deposit account, etc., or threaten liquidation. Barrow (1976) and Black and de Meza (1992) demonstrate how collateral can improve efficiency by counteracting borrower incentives to underreport or divert business returns.

All three types of moral hazard based models are consistent with the ubiquitous observed use of collateral in the SME credit market, (Coco, 2009). Further, unlike models developed in the context of adverse selection, they do not predict a negative correlation between borrower risk and the use of collateral. The model developed in the next section is within this tradition.

A Collateral Model with Moral Hazard¹⁵

As suggested in the preceding review of the theoretical literature on collateral, the literature has, to date, not addressed differences between collateral and personal guarantees of the business owner as types of credit enhancement. Thus, we know little about the contracting circumstances under which credit enhancement will take the form of a guarantee rather than of collateral.

In this section, I extend a simple model of credit contracting under moral hazard to include the full range of costs associated with the use of collateral. This extension adds the up-front, fixed costs incurred to appraise and perfect a security interest in the assets serving as collateral. It also recognizes the borrower's utility losses which arise from diminished ownership rights in assets pledged as collateral. In the following section the same basic model is modified to incorporate the transactions costs associated with a guarantee. I then show if the guarantor has sufficient outside net worth, the equilibrium form of credit enhancement will be a guarantee. If the guarantor has insufficient wealth, enhancement will be achieved with collateral.

In a model with moral hazard, collateral plays an incentive role in the borrower's ex post choice of action or effort level. This environment is particularly applicable to lines of credit in the SME credit market. Lines of credit afford the borrower access to new funds (up to the commitment amount) over the term of the line commitment (usually one year). Funds are generally disbursed at the borrower's demand without the disbursement controls associated with loans granted for specific asset acquisitions, such

¹⁵ This model is based on Boot and Thakor (1994).

as commercial mortgage loans, equipment loans, and vehicle loans. The inherent flexibility in the line of credit structure provides increased opportunity for the borrower to take actions after the contract is signed which are not socially optimal.¹⁶ The privately held nature of MSEs and preponderance of owner management provides clear opportunity for confounding of the firm's profit function with the utility of the owners.

A moral hazard model also has the advantage of consistency with the pattern of risk and collateral use most frequently found in the empirical literature. In their recent survey of the literature, Steijers and Voordeckers (2009) conclude studies of the relationship between SME risk and the propensity for the firm's debt to be enhanced with collateral have almost uniformly found collateral use is positively related to measures of firm risk. These results are at odds with the relationship predicted by adverse selection models and suggest the adverse selection mechanism may not be prevalent in the SME credit markets.

Model Assumptions

- A1) The borrower and lender are both risk-neutral agents.
- A2) Credit markets are competitive, so the lender's participation constraint is binding.
- A3) The bank lender has access to loanable funds at a constant marginal cost, r , the riskless interest rate, and lends at interest rates, i , with $i \geq r$.

¹⁶ In the model that follows socially optimality means that an owner of the project expends "high" effort so that it will succeed rather than a lower level of effort.

A4) The borrower has an investment opportunity costing \$1 and, if successful, yielding a one-time gross return of $R > 1$ one year later. If unsuccessful, the investment return is 0.

A5) The probability of project success, p , is a function of the effort level, e , chosen by the borrower with $p(0) = 0$, $p'(e) > 0$ and $p''(e) < 0$. For simplicity, the set of effort levels is $\{0, e_2, e_1\}$ with $0 < e_2 < e_1$, where e_1 represents the feasible first best effort level and e_2 represents a second best effort level. The probabilities of project success associated with these effort levels are, $p(0) < p(e_2) < p(e_1)$.¹⁷

A6) Effort is costly to the owner-manager. This cost or disutility of effort is given by $V(e)$ with $V(0) = 0$, $V'(e) > 0$ and $V''(e) > 0$, so $V(e_0) < V(e_2) < V(e_1)$.

A7) The borrower's expected internal rate of return on the project is greater than the interest rate, i^* , offered in the loan contract so the borrower will undertake the project if financing is offered. Therefore the effective choice set for effort levels is $\{e_2, e_1\}$.

A8) The borrower is organized with limited liability and returns to unsecured claimants in bankruptcy are 0. This means the only sources of repayment to the lender are project returns, R , and proceeds from the liquidation of collateral.

A9) The firm is privately and closely held. Therefore, firm-owned assets not pledged as collateral can be liquidated and proceeds diverted to the owner. Thus,

¹⁷ I will refer to e as effort level; however, it may stand for other ex-post actions such as additional risk assumption or asset diversion.

collateral pledged, C , may be either inside collateral (firm-owned) or outside collateral (property owned personally by the business owner).¹⁸

A10) Collateral is costly in three ways:

- 1) The lender's fixed transactions costs, δ_1 , incurred to both evaluate and legally perfect security interests in the collateral before the loan is closed as well as the expected costs of monitoring collateral during the loan term.
- 2) A proportional utility loss, δ_2 , to the borrower associated with the loss of full property rights to the collateral while it is pledged to the lender.
- 3) The proportional loss in the going value of the collateral, $(1 - \delta_3)$, that occurs if default occurs and it has to be liquidated. Under this specification the proportion δ_3 represents the salvage value of the collateral.

A11) The borrower has an initial endowment of wealth, $W_0 > 0$. The borrower could liquidate wealth to self-finance a portion of the project or, if $W_0 > 1$, the entire project. Liquidating wealth is, however, costly and yields investible funds of only $\delta_g \cdot W_0$, with $0 < \delta_g < 1$. I assume that $\delta_g < 1/(1+i^*)$. That is, proportionate wealth liquidation costs are high enough that the effective cost of equity financing

¹⁸ This assumption differs from much of the literature but captures a key agency problem in dealing with a closely held, private business where personal utility and business objective functions are likely to be confounded.

provided by liquidating wealth is greater than the cost of debt capital. The borrower, therefore, will seek to finance the project in the intermediated credit market.

The Optimal Debt Contract with Collateral

In an environment where effort level is the sole form of private information, the borrower seeks to undertake a project with an expected rate of return greater than the market rate of interest. The project costs \$1 and provides two possible returns at the end of one year: $R > \$1$ if successful, and \$0 if not. The probability of achieving a project success, $p(e)$, is an increasing function of the owner-manager's effort level, e . There is, however, disutility associated with effort, $V(e)$, with $V'(e) > 0$ and $V''(e) < 0$. The borrower chooses an effort level, e^* , to maximize his utility after a credit contract is offered by the lender.

Since the credit market is assumed to be perfectly competitive and there is no informational advantage accruing to an existing bank, all banks will earn zero expected profits and all expected surplus will go to the borrower. This environment is modeled as one in which a competitive bank designs and offers a contract which maximizes the borrower's expected net return from its project subject to lender's binding participation constraint.

More formally, the lender designs the credit contract, $\{i, C\}$, consisting of an interest rate, i , and collateral requirement, C . The effort level chosen is not observable and thus cannot be an element of the credit contract. Since there are no ex-ante

informational frictions, however, all potential lenders know the probability of project success, $p(e)$, at each effort level in the borrower's choice set; the borrower's utility cost, $V(e)$, associated with each effort level; and the return, R , on a successful project. By assumption A3, lenders face the same infinitely elastic supply of loanable funds, at a cost of r in the deposit market. Further, under perfect competition, all lenders employ identical lending technologies and thus face the same costs for perfecting their security interest in collateral and face identical foreclosure and liquidation costs. As a result, δ_1 and δ_3 are common to all lenders. The lender then designs and offers a secured credit contract in the interest rate/collateral space, $\{i, C\}$, that solves the following program:

$$\text{Max}\{i, C\} : E(U_b) = p(e^*)R - p(e^*)(1+i) - [1 - p(e^*)]C - \delta_2 C - V(e^*) \quad (\text{C1})$$

Subject to:

2a. the bank's participation constraint requiring non-negative expected profits:

$$E(\Pi_L) = p(e^*)(1+i) + [1 - p(e^*)]\delta_3 C - \delta_1 \geq (1+r) \quad (\text{C2})$$

2b. the incentive compatibility constraint for the borrower's choice of effort level:

$$e^* \in \arg \max \{ p(e)R - p(e)(1+i) - [1 - p(e)]C - \delta_2 C - V(e) \} \quad (\text{C3})$$

3b. the non-negativity or feasibility constraints on the contracting variables:

$$i \geq 0, C \geq 0$$

Were the borrower's choice of effort level observable, the optimal equilibrium contract would be an unsecured loan. The competitive lender would set $C = 0$ to avoid the dissipative costs, δ_1 , δ_2 and $(1 - \delta_3)$, associated with collateralization. The equilibrium interest rate would then be the zero profit solution to the lender's participation constraint, (C2), with $C = 0$: $E(\pi_L) = p(e_i)(1 + i) + (1 - p(e_i))\delta_3 0 - 0 - (1 + r) = 0$. Solving for the interest rate we have: $i^* = \frac{(1+r)}{p(e_i)} - 1$ where e_i is the borrower's effort level that maximizes his expected utility.

If effort level is observable, it can be a term in the credit contract and the borrower's incentive compatibility contract, (C3), need not be considered. Instead, the first best effort choice, $e^* = \arg \max \{p(e_i)R - 1 - V(e_i)\}$: the effort level that maximizes the borrower's expected net utility gain from undertaking the project. We assume that $e^* = e_1$, the first best feasible effort level, so the optimal contract with observable effort is

$$\text{Collateral Result 1: } \{i^*, C^*\} = \begin{cases} \frac{(1+r)}{p(e_1)}, 0 & | e = e_1 \\ (R - 1), 0 & | e \neq e_1 \end{cases} \quad (\text{C4})$$

The equilibrium credit contract with observable effort is unsecured, with an interest rate just sufficient to provide the lender with zero expected profit if the borrower exerts effort level e_1 and an interest rate set to take all project returns if the borrower exerts an effort level other than e_1 . Under this contract, the borrower will choose effort level e_1 and the lender's realized profit will be

$$p(e_1) \frac{(1+r)}{p(e_1)} - (1 + r) = 0 \quad (\text{C5})$$

If effort level is not observable and moral hazard exists, an unsecured loan is no longer efficient. If effort level is private information of the borrower, it cannot be an element of the credit contract as in C4. Rather, the incentive compatibility constraint, C3, must hold so that $p(e_1)(R - (1 + i)) - V(e_1) > p(e_2)(R - (1 + i)) - V(e_2)$ for the borrower to choose e_1 . If, however, moral hazard exists, then by definition

$$p(e_1)\left(R - \frac{(1+r)}{p(e_1)}\right) - V(e_1) < p(e_2)\left(R - \frac{(1+r)}{p(e_1)}\right) - V(e_2) \quad (C6)$$

and the borrower will choose the lower, second best effort level, e_2 . The lender anticipates this and sets the interest rate,

$$i^* = (1+r)/p(e_2) - 1 > (1+r)/p(e_1) - 1. \quad (C7)$$

Thus, in the face of moral hazard and non-observable effort level, an unsecured credit contract cannot support a first best effort level. The higher interest rate charged by the lender, $(1+r)/p(e_2)$ reduces the borrower's return to effort in the successful state and so fails to support the choice of an efficient effort level.

Collateral Result 2: In the face of moral hazard and non-observable effort level, an unsecured credit contract is inefficient.

I now show how collateral can improve the efficiency of inter temporal trade in cash flows in a debt contracting environment characterized by moral hazard. For a

secured debt contract, $\{i, C\}$ with $C > 0$, to provide a more efficient equilibrium contract, it must be that

$$p(e_1)[R - (1 + i)] - (1 - p(e_1))C - \delta_2 C - V(e_1) > p(e_2)[R - (1 + i)] - V(e_2). \quad (C8)$$

That is, the borrower's expected utility gain with a secured loan and a first best effort choice must be greater than the borrower's expected utility gain from an unsecured loan and the second best effort level.

I begin by restating the lender's participation constraint, (C2), and the borrower's incentive compatibility constraint, (C3), to reflect the first best feasible and second best effort levels:¹⁹

The bank must earn non-negative expected profits:

$$p(e_1)[(1 + i)] + [1 - p(e_1)]\delta_3 C - \delta_1 - (1 + r) \geq 0 \quad (C9)$$

Under the terms of the credit contract, the borrower must be at least as well off if e_1 is chosen instead of e_2 :

$$p(e_1)[(R - (1 + i))] - [1 - p(e_1)]C - \delta_2 C - V(e_1) \geq p(e_2)(R - (1 + i)) - [1 - p(e_2)]C - \delta_2 C - V(e_2) \quad (C10)$$

¹⁹ The term 'feasible first best effort level' is used to emphasize that the optimal of first first-best effort level can only be obtained in the case of observable effort choice.

The Lagrangian for deriving the optimal credit contract in the $\{i, C\}$ space can now be written as follows:

$$\mathcal{L} = p(e_1)[R - (1 + i)] - [1 - p(e_1)]C - \delta_2 C - V(e_1) \quad (C11)$$

$$- \gamma\{(1 + r) + \delta_1 - p(e_1)(1 + i) - [1 - p(e_1)]\delta_3 C$$

$$- \varphi\{-[p(e_1) - p(e_2)][R - (1 + i)] - [p(e_1) - p(e_2)]C + [V(e_1) - V(e_2)]\}$$

With the two first order conditions:

$$\text{FOC 1: } \frac{\partial \mathcal{L}}{\partial i} = -p(e_1) + \gamma p(e_1) - \varphi [p(e_1) - p(e_2)] = 0 \quad (C12)$$

$$\text{FOC 2: } \frac{\partial \mathcal{L}}{\partial C} = -[1 - p(e_1)] - \delta_2 + \gamma[1 - p(e_1)]\delta_3 + \varphi[p(e_1) - p(e_2)] = 0 \quad (C13)$$

The two first order conditions can be used to derive expressions for the two Lagrangian multipliers:

$$\gamma = \frac{1 + \delta_2}{((1 - p(e_1))\delta_3 + p(e_1))} > 0 \quad (C14)$$

$$\varphi = \frac{p(e_1)}{[p(e_1) - p(e_2)]} \left\{ \frac{1 + \delta_2}{[1 - p(e_1)]\delta_3 + p(e_1)} - 1 \right\} > 0 \quad (C15)$$

Since both multipliers are non-zero, the lender's participation constraint, (C9), and the borrower's incentive compatibility constraint, (C10), can be written as equalities and solved for the optimal interest rate and collateral amount, $\{i^*, C^*\}$. The results below give the optimal equilibrium credit contract.

$$\text{Collateral Result 3: } i^* = \frac{1+r+\delta_1}{p(e_1)} - \frac{[1-p(e_1)]\delta_3 C^*}{p(e_1)} - 1 \quad (\text{C16})$$

$$C^* = \frac{p(e_1)}{[1-p(e_1)]\delta_3 + p(e_1)} \left[\frac{V(e_1) - V(e_2)}{p(e_1) - p(e_2)} - R + \frac{(1+r)+\delta_1}{p(e_1)} \right] \quad (\text{C17})$$

These results show that an optimal contract involving the use of collateral can reduce moral hazard and elicit the borrower's choice of e_1 . Collateral enables this result in two related ways. First, collateral increases the utility loss to the borrower in the unsuccessful state. The borrower consequently has incentive to expend greater effort to increase the probability of investment success. Secondly, by increasing the lender's return in the unsuccessful state, the use of collateral allows a competitive lender to meet its participation constraint with a lower interest rate in the successful state. This lower interest rate increases the borrower's marginal return to effort. The effects of the interest rate and collateral on returns to effort can be more formally derived by taking the partial derivative of the borrower's utility function (1) with respect to effort:

$$\frac{\partial U_b}{\partial e} = p'(e)[R - (1 + i) + C] - V'(e) \quad (\text{C18})$$

which is decreasing in i and increasing in C .

If the borrower has sufficient collateralizable wealth to make the return to the lender independent of project success, then a simple form for the optimal contract, $i^* = r + \delta_1$ and $C^* = (1 + r + \delta_1)/\delta_3$, can be derived from the lender's zero profit participation constraint at an effort level of e_1 . In this situation, the lender's claim is no longer risky. This result highlights the role of collateral as an incentive device in

environments of moral hazard. This role is independent of the degree of fundamental repayment risk, $p(e_1)$. The guarantee model developed in the next section will show however, that such a wealthy borrower will be better off guaranteeing the loan rather than providing this amount of collateral.

It is also important to note that the efficiency gain provided by collateral must exceed the dissipative or dead weight costs associated with its use. In the model above, these costs are parameterized as δ_1 , transactions costs incurred in the ex-ante evaluation and legal perfection of security interests; δ_2 , utility losses associated with the borrower's diminished property rights to the pledged assets;²⁰ and δ_3 , transactions and liquidation costs incurred by the lender in obtaining and disposing of the collateral in the event of default. If these costs, individually or in combination, are sufficiently large relative to the loan amount, the efficiency enhancing role of collateral will be overturned and projects with otherwise positive net present values will not be financed. In such cases, collateral cannot efficiently mitigate credit market failures associated with moral hazard in the SME loan market. Such failures are not however, examples of credit rationing.

Collateral, Market Failures, and Credit Rationing

Credit rationing occurs in equilibrium whenever “some borrower's demand for credit is turned down, even though the borrower is willing to pay all the price and non-price elements of the loan contract” (Baltensperger, 1978). This definition limits the occurrence of rationing to those situations in which the borrower is willing and able to

²⁰ Benjamin (1978) discusses this cost at some length. Pawning assets is an extreme example of diminished property rights.

accept the terms of credit contracts offered in a competitive credit market, yet is still unable to obtain credit.²¹ If a potential borrower does not seek credit because equilibrium interest rate, i^* , is greater than the expected return on the project to be financed, net of collateral costs, they have not been rationed. Similarly, borrowers with positive net present value projects at i^* who lack sufficient collateral or outside net worth to meet prevailing (equilibrium) market requirements for non-price loan terms have not been rationed. In these cases, the price and non-price elements of the prevailing credit contract have appropriately served to allocate scarce savings to other investment uses.

In general, rationing in the Baltensperger framework is associated with a backward-bending credit supply curve, a situation which arises when the bank's profit function (credit supply curve) does not increase monotonically with an increase in the interest rate. In this case, there will be borrowers willing and able to pay an interest rate greater than or equal to the market rate to whom the bank will not lend. This result can arise in several environments. Where there are ex-ante informational asymmetries regarding the risk characteristics of credit applicants and the attendant problem of adverse selection, increases in the interest rate may increase the average risk of the firms demanding credit. If the average risk of borrowers increases sufficiently, the bank's expected lending profit will decline and its credit supply function will decrease after some interest rate. Similar results can be obtained in modeling environments of moral

²¹ Keeton (1979) further distinguishes between cases where all members of a given group are denied full credit access (type I rationing) and cases where only some members of an otherwise homogenous group are denied credit access (type II rationing).

hazard where increases in market interest rates provide borrowers with increased incentives to take ex-ante actions which redistribute expected returns from the bank to themselves.

Collateral (and guarantees) can mitigate the effects of informational problems in environments of both adverse selection and moral hazard and avoid a backward-bending credit supply curve. In conditions of adverse selection, the expected cost of providing collateral is higher for riskier borrowers, and hence, menus of contracts with different combinations of collateral requirements and interest rates can be used as a mechanism for opaque borrowers to reveal their riskiness. In modeling environments of moral hazard, collateral increases the borrower's losses in the event of default, and hence, offsets ex-post incentives for the borrower to take actions which reallocate expected returns to the borrower at the expense of the lender.

Modifying the Collateral Model for Guarantee Attributes and Owner Wealth

In this section, I modify the collateral model to reflect the specific attributes of a guarantee and to incorporate the effect of the guarantor's outside net worth.

Model Assumptions

Assumptions A1– A7, A9, and A11 are unchanged.

A8) is changed trivially to limit sources of repayment to $\$R$ if the investment is successful and to payments from the guarantor's outside net worth if the investment is not successful.

A10) is changed significantly. The guarantee is costly only in the case of default, transactions costs of converting assets into liquid form are incurred by the guarantor rather than the lender, and the repayment value of the guarantee depends on the guarantor's net worth at the time of default. The repayment value of the guarantee, G , is thus given by $\text{argmin}\{(1+i), W\delta_g\}$ where W is the guarantor's wealth at the end of the loan term, $\delta_g = (1 - \text{personal asset liquidation costs})$ and $(1+i)$ is the loan repayment amount. Finally, other than asset liquidation costs, δ_g , there are no other transactions costs associated with executing a guarantee.

The Optimal Debt Contract with a Personal Guarantee and Variable Wealth

As before, we have a risk-neutral business with a positive net present value investment project requiring a \$1 investment today and providing a return in one year. The project return is either $R > \$1$ if successful, or \$0 if not. The probability of success, $p(e)$, depends on the owner-manager's choice of effort, e . The effort level, $e \in \{0, e_2, e_1\}$ is chosen after the owner-manager is offered financing and $p(0) = 0 < p(e_2) < p(e_1)$. Effort is costly to the owner-manager with this cost represented by $V(e)$ with $V(0) = 0 < V(e_2) < V(e_1)$ and $V'(e) > 0$ and $V''(0) > 0$.

The firm owner has an initial endowment of collateralizable wealth, W_0 ; however, liquidating this wealth to finance the firm's project with equity is costly to the borrower. The owner's cost of converting wealth to cash is greater than the firm's cost of capital, i . There are no other outside sources of funding; hence the borrower will seek to finance its

project in the intermediated credit market. The amount and composition of the guarantor's personal wealth is known to potential lenders.

The bank credit market is competitive. Banks face an elastic supply of loanable funds at a constant marginal cost r , the riskless interest rate. Banks are assumed to be risk neutral. The bank offers a credit contract consisting of a repayment $(1 + i)$ and a guarantee requirement G . After accepting this contract, the borrower chooses a non-observable effort level which, in turn, affects the probability of investment success. The lender, then offers a credit contract, $\{i, G\}$ that solves the following program:

$$\text{Max}\{i, G\}: \quad E(U_b) = p(e^*)R - V(e^*) - p(e^*)(1 + i) - [1 - p(e^*)]G / \delta_g \quad (\text{G1})$$

Subject to:

The bank's participation constraint requiring non-negative expected profits:

$$E(\Pi_L) = p(e^*)(1 + i) + [1 - p(e^*)]G \geq (1 + r) \quad (\text{G2})$$

The incentive compatibility constraint for the borrower's choice of effort level:

$$e^* \in \arg \max \{ p(e)[R - (1 + i)] - [1 - p(e)]G / \delta_g - V(e) \} \quad (\text{G3})$$

The non-negativity constraints:

$$\text{IIC. } i \geq 0, G \geq 0 \quad (\text{G4})$$

The guarantee valuation correspondence, which limits the feasible repayment value of the guarantee to the owner's outside net worth less costs of asset liquidation:

$$\text{IId. } G = \min\{(1+i), W\delta_g\} \quad (\text{G5})$$

One way to characterize the solution is to analyze the effects of guarantor wealth on the lender's participation constraint, (G2). In a competitive credit market, this constraint will be binding at the zero profit level and will determine the borrower's cost of capital. Here I rewrite this constraint as:

$$E(\Pi_L) = p(e^*)(1+i) + [1 - p(e^*)]\min\{(1+i), W\delta_g\} - (1+r) = 0 \quad (\text{G6})$$

In the case of a "wealthy guarantor" where $W\delta_b \geq (1+i)$, the return to the bank is state independent and independent of the effort level:

Guarantee Result 1:

$$E(\Pi_L) = p(e)(1+i) + [1 - p(e)](1+i) - (1+r) = 0 = (1+i) - (1+r) \Rightarrow i^* = r \quad (\text{G7})$$

The lender incurs no risk and the firm borrows at the minimum, riskless cost of capital, r . Since this wealthy guarantor realizes all gains and losses, they earn all marginal returns to effort and choose the first best effort level. This result contrasts with that in the collateral based model. In the collateral model, dead weight losses from the ex-ante transactions costs of pledging collateral reduced the marginal expected return to effort, causing

distortions in optimal effort. Using equation (G3), the first best effort level is that which maximizes the firm's expected return from the project: $e^* \in \arg \max \{p(e)R - V(e) - (1+r)\} = e_1$.

In the case of risky debt where $(1+i) > W\delta_g > 0$, the solution $\{i^*, G^*\}$ can be derived as follows, let $\{e_1, e_2\}$ be first and second best effort levels such that the incentive compatibility constraint is satisfied so G3 can be rewritten as

$$p(e_1)[R - (1+i)] - [1 - p(e_1)]G/\delta_g - V(e_1) \geq p(e_2)[R - (1+i)] - [1 - p(e_2)]G/\delta_g - V(e_2) \quad (G8)$$

The Lagrangian for G1 – G4 can be now be written as follows:

$$\begin{aligned} L = & p(e_1)[R - (1+i)] - [1 - p(e_1)]G/\delta_g - V(e_1) \\ & - \lambda[(1+r) - p(e_1)(1+i) - [1 - p(e_1)]G] \\ & - \mu[0 - [p(e_1) - p(e_2)][R - (1+i)] - [p(e_1) - p(e_2)]G/\delta_g + [V(e_1) - V(e_2)]] \end{aligned} \quad (G9)$$

The first order conditions are:

$$\text{FOC 1: } \frac{\partial L}{\partial i} = -p(e_1) + \lambda p(e_1) - \mu[p(e_1) - p(e_2)] = 0 \quad (G10)$$

$$\text{FOC 2: } \frac{\partial L}{\partial G} = -(1 - p(e_1))/\delta_g + \lambda(1 - p(e_1)) + \mu[p(e_1) - p(e_2)]/\delta_g = 0 \quad (G11)$$

Solving FOC 1 and FOC 2 for λ produces:

$$\lambda = \frac{1}{[\delta_g(1 - p(e_2)) + p(e_2)]} > 0 \forall \delta_g \in (0,1) \quad (G12)$$

$$\mu = \frac{p(e_1)}{[p(e_1) - p(e_2)]} * \left[\frac{1}{[\delta_g(1 - p(e_1)) + p(e_1)]} - 1 \right] > 0 \forall \delta_g \in (0,1) \quad (G13)$$

Since $\lambda > 0$ and $\mu > 0$, both the lender's participation constraint, (G2), and the incentive compatibility constraint, (G8), are binding and can be rewritten as equalities and solved for i^* and G^* . From the lender's participation constraint, solving for i^* gives:

$$\text{Guarantee Result 2: } i^* = \frac{(1+r) - [1 - p(e_1)]G^*}{p(e_1)} - 1 \quad \text{if } W\delta_g \geq G^* \quad (\text{G14})$$

Substituting GR2 into the incentive compatibility constraint and solving for G^* results in

Guarantee Result 3:

$$G^* = \frac{\delta_g p(e_1)}{p(e_1) + \delta_g (1 - p(e_1))} * \left[\frac{(1+r)}{p(e_1)} - R + \frac{(V(e_1) - V(e_2))}{p(e_1) - p(e_2)} \right] \quad \text{if } W\delta_g \geq G^* \quad (\text{G15})$$

The final case is that of an impoverished owner where $G = W\delta_g = 0$. In this case, the presence of a guarantee in the credit contract affects neither the lender's expected profit nor the borrower's expected utility. In effect, the situation is analogous to that of an unsecured loan in the collateral model. With similar assumptions regarding the existence of moral hazard, the equilibrium effort level will be e_2 and the incentive compatibility constraint is no longer germane to the solution. Since the credit market is competitive, the lender's participation constraint will be binding. With $G = 0$, this

constraint can be written as $p(e)(1+i) = (1+r)$ so $i^* = \frac{(1+r)}{p(e^*)} - 1$ and the effort level chosen will be second best e_2 .²²

Guarantee Result 4: Where the guarantor has no wealth, the optimal contract is

$$\{ i^* = \frac{1+r}{p(e_2)} - 1, G^* = \varepsilon(0,1) \} \quad (G16)$$

The Effect of Owner Wealth on the Cost of Capital

As owner wealth increases, the repayment value of the guarantee increases. A simple way to identify the effect of owner wealth on the firm's cost of debt capital is to look at the lender's participation constraint, (G2), where the repayment value of the guarantee, $G_g = \delta_g W$:

$$E(\Pi_L) = p(e^*)(1+i) + [1-p(e^*)]\delta_g W \geq (1+r) \quad (G17)$$

In a competitive market, this constraint will be binding and can be written as an equality.

Writing this as an equality and rearranging terms, yields

$$i = \frac{1+r}{p(e^*)} - \frac{[1-p(e^*)]\delta_g W}{p(e^*)} - 1. \quad (G18)$$

²² The choice of second best effort level follows from the higher interest rate required by the lender's participation constraint in the absence of any repayment from an impoverished guarantor in the default state. This higher interest rate reduces the borrower's return from effort. Further, the higher likelihood of default from a lower effort level does not increase the loss of personal wealth in the event of default.

Taking the partial derivative with respect to outside net worth, we have:

$$\frac{\partial i}{\partial W} = - \frac{[1-p(e^*)]\delta g}{p(e^*)} < 0. \quad (G19)$$

The greater the outside net wealth of the guarantor (up to the loan repayment amount), the lower the interest rate charged by the competitive lender.

If the repayment value of the guarantee is the full amount of the loan repayment,

$1 + i$, then

$$i = \frac{1+r}{p(e^*)} - \frac{[1-p(e^*)](1+i)}{p(e^*)} - 1 \quad (G20)$$

which reduces to $i = r$, the riskless rate. If the repayment value of the guarantee is 0, then

$$i = \frac{1+r}{p(e^*)} - 1 > r. \quad (G21)$$

Thus, where credit enhancement consists of a personal guarantee only, the borrower's

cost of capital falls from $i = \frac{1+r}{p(e^*)} - 1$, in the case of an impoverished guarantor, to

$i = r$ in the case of a guarantor with sufficient wealth to make loan repayment

independent of the success or failure of the borrowing firm.

The Relative Efficiency of Guarantees and Collateral

I have shown how both forms of credit enhancement can improve efficiency in the SME credit market in the presence of moral hazard. The remaining task is to identify

the conditions under which guarantees will emerge as the more efficient, or equilibrium, enhancement vehicle in the SME credit contract. This will depend on the interplay of three factors; 1) the amount of the utility loss associated with collateralization, 2) the dissipative transaction costs associated with collateralization, and 3) the relative repayment values of a guarantee and collateral in the event of default. This latter factor depends, in turn, on the amount of guarantor wealth.

Under the assumption of a competitive credit market, the relative efficiency of the two forms of enhancement will be reflected in the borrower's relative utility level. This utility is given by the objective functions in the guarantee and collateral models:

$$\text{For Collateral: } U_c^* = p(e_1)[R - (1 + i_c^*)] - [1 - p(e_1)]C^* - \delta_2 C^* - V(e_1) \quad (\text{E1})$$

$$\text{For a Guarantee: } U_g^* = p(e_1)[R - (1 + i_g^*)] - [1 - p(e_1)]G^*/\delta_g - V(e_1) \quad (\text{E2})$$

The relative efficiency improvement from enhancement with a guarantee is thus given by:

$$U_g^* - U_c^* = p(e_1)[i_c^* - i_g^*] + [1 - p(e_1)][C^* - G^*/\delta_g] + \delta_2 C. \quad (\text{E3})$$

If $U_g^* - U_c^* > 0$, a guarantee will emerge as optimal form of enhancement in the equilibrium credit contract, provided that $W\delta_g > G^*$. If $U_g^* - U_c^* < 0$, collateral enhancement will emerge in the equilibrium credit contract.²³

²³ At this point, I do not consider the conditions under which both forms of enhancement might emerge in the equilibrium debt contract.

In this format, the relative efficiency of collateral and a guarantee is determined by the net of three effects. The first is the difference in the expected interest payments in the successful state, $p(e_1)[i_c^* - i_g^*]$. The second is the difference in the expected utility lost from wealth losses in the event of default, $(1 - p(e_1))[C^* - G^*/\delta_g]$. The third is the loss of utility arising from reduced dominion over borrower property pledged as collateral. This latter term always serves to diminish the relative efficiency of collateral. This leaves us to consider the efficiency effects of the two former terms.

The first term is the difference in the optimal interest rate solutions to the guarantee and collateral contracting problems, weighted by the probability of business success. The two solutions were:

$$\text{For a guarantee: } i_g^* = \frac{1+r}{p(e_1)} - \frac{[1-p(e_1)]G^*}{p(e_1)} - 1 \quad (\text{E4})$$

$$\text{For collateral: } i_c^* = \frac{1+r+\delta_1}{p(e_1)} - \frac{[1-p(e_1)]\delta_3 C^*}{p(e_1)} - 1 \quad (\text{E5})$$

The difference in the cost of capital,

$$\begin{aligned} i_c^* - i_g^* &= \frac{1+r+\delta_1}{p(e_1)} - \frac{1+r}{p(e_1)} + \frac{[1-p(e_1)]G^*}{p(e_1)} - \frac{[1-p(e_1)]\delta_3 C^*}{p(e_1)} \\ &= \delta_1/p(e_1) + [1 - p(e_1)][G^* - \delta_3 C^*]/p(e_1) \end{aligned} \quad (\text{E6})$$

Substituting (E6) into the utility difference equation, (E3), without the third term, yields:

$$\begin{aligned} U_g^* - U_c^* &= [\delta_1 + [1 - p(e_1)][G^* - \delta_3 C^*]] + (1 - p(e_1))[C^* - G^*/\delta_g] \\ &= \delta_1 + [1 - p(e_1)][C^*(1 - \delta_3) - G^*((1 - \delta_g)/\delta_g)] \end{aligned} \quad (\text{E7})$$

The effect of the first term, δ_l , unambiguously increases the borrower's utility when enhancement takes the form of a guarantee rather than collateral. This term reflects the lender's need to set the interest rate high enough to recover the fixed costs incurred to evaluate, perfect a security interest in, and to monitor collateral. There are no corresponding costs associated with a guarantee.

With two of the terms, δ_1 and $\delta_2 C^*$ increasing the relative utility of a guaranteed credit contract, the remaining task is to evaluate the second term, which is the difference in the expected wealth losses that the borrower will incur in the event of default, $[1 - p(e_1)][C^*(1 - \delta_3) - G^*((1 - \delta_g)/\delta_g)]$. The directional effect of this term depends on both the relative efficiency of the guarantor and lender in liquefying, respectively, wealth and collateral and the difference in the amount of collateral and guarantee in the respective optimal contracts.

In the absence of empirical evidence on the relative efficiency of lenders (banks) and business owners in selling assets, several practical considerations suggest the owner of property is generally able to realize a greater return on its disposition than is a lender.²⁴ First, the owner does not need to go through a legal process such as foreclosure prior to sale. The costs associated with the title transfer to the lender before a sale can take place strictly reduce δ_3 compared to δ_g . Secondly, the guarantor-owner of an opaque SME is likely to have prior knowledge of the possibility of default and can begin marketing assets before it is known that they are being sold at a "foreclosure sale." Finally, where the guarantor has multiple asset classes from which he can choose to liquidate, he can

²⁴ See Benjamin (1978) for a similar argument.

choose the one with the lowest liquidation costs. I assume then, that δ_3 is sufficiently small relative to δ_g that $(1 - \delta_3) > (1 - \delta_g)/\delta_g$.

The final step in finding the sign of $U_g^* - U_c^*$ is to compare the equilibrium amounts of collateral and guarantee enhancement, C^* and G^* . From the solutions to the collateral and guarantee contracting problems, we have the following:

$$C^* = \frac{p(e_1)}{[1-p(e_1)]\delta_3+p(e_1)} \left[\frac{(1+r)+\delta_1}{p(e_1)} - R + \frac{V(e_1)-V(e_2)}{p(e_1)-P(e_2)} \right] \quad (\text{E8})$$

$$G^* = \frac{\delta_g p(e_1)}{p(e_1) + \delta_g (1 - p(e_1))} * \left[\frac{(1+r)}{p(e_1)} - R + \frac{(V(e_1) - V(e_2))}{p(e_1) - p(e_2)} \right] \quad (\text{E9})$$

With the presence of δ_1 in the numerator of the first term of the C^* equation,

$$\left[\frac{(1+r)+\delta_1}{p(e_1)} - R + \frac{V(e_1)-V(e_2)}{p(e_1)-P(e_2)} \right] > \left[\frac{(1+r)}{p(e_1)} - R + \frac{V(e_1)-V(e_2)}{p(e_1)-P(e_2)} \right] \quad (\text{E10})$$

C^* will be unambiguously larger than G^* if $\frac{p(e_1)}{[1-p(e_1)]\delta_3+p(e_1)} > \frac{\delta_g p(e_1)}{[1-p(e_1)]\delta_g+p(e_1)}$.

Rearranging terms restates this condition as $\delta_g [p(e_1) + \delta_3 (1 - p(e_1))] < p(e_1) +$

$\delta_g [1 - p(e_1)]$. Since $1 > \delta_g > 0$ and $1 > \delta_g > \delta_3 > 0$, this inequality holds. C^* is,

therefore greater than G^* . This completes the proof that $U_g^* > U_c^*$ provided that the guarantor has sufficient outside net worth to provide a guarantee with a repayment value of at least G^* .

$$\text{Efficiency Result 1: } U_g^* > U_c^* \quad \text{if } \delta_g W \geq G^* \quad (\text{E11})$$

In deriving ER1, I have imposed the condition that borrowers are more efficient in liquidating assets than are lenders as a necessary condition: $\delta_g > \delta_3$. Since the other dissipative costs, δ_1 and δ_2 are only incurred with credit enhancement in the form of collateral and are strictly positive, this condition is sufficient to show that $U_g^* > U_c^*$. The condition $\delta_3 < \delta_g$ is also consistent with modeling assumptions commonly made in the literature. This condition is not, however, strictly necessary. It can be shown that the ER1 result can be obtained for $\delta_g < \delta_3$ if δ_1 and δ_2 are sufficiently large.

There are cases in which the assumption that borrowers are more efficient in liquidating assets than are lenders does not hold and in which both the fixed costs associated with taking collateral, δ_1 , and the utility loss from diminished property rights in the collateral, $\delta_2 C$, are small enough that collateral will be a more efficient form of credit enhancement. Such cases will likely exist even for a borrower with sufficient wealth to make a guarantee contract feasible. One such type of loan is the lease of a company car for the business owner. In this case, the leasing company is likely to be more efficient in liquidating the car and both the marginal costs of collateralization and utility loss from impaired ownership rights to the car are negligible. In general, these conditions are likely to exist when dealers or manufacturers finance the acquisition of their products.

Extensions of the Basic Models

Contracts with Both Collateral and Guarantees

One empirical observation is the frequency with which both collateral and a personal guarantee appear in the equilibrium credit contract. Table 1.1 shows that 26 percent of lines of credit with the firm's lead bank in the 2003 Survey of Small Business Finances are credit enhanced with both collateral and a guarantee. This leads to the consideration of the circumstances under which both forms of enhancement will appear in the equilibrium debt contract.

In the previous section, I showed that the credit contract, $\{i^*, G^*\}$ is, in general, a more efficient than the contract $\{i^*, C^*\}$. It will thus arise as the equilibrium contract in a competitive SME credit market if the guarantor is sufficiently wealthy. This follows from the lower level of dissipative costs associated with collateral. The credit contract $\{i^*, G^*\}$ is only feasible, however, if the guarantor has sufficient outside wealth relative to the loan amount.

When the wealth of the potential guarantor is insufficient to make $\{i^*, G^*\}$ a feasible contract, we can easily show that a contract in the $\{i, C, G\}$ space where both C^* and G^* are strictly positive may arise as the equilibrium contract. This result will obtain since owner wealth backing a guarantee can both support some positive level of expected lender repayment in the case of default and serve as an incentive mechanism toward eliciting a first best effort choice by the borrower. Importantly, the guarantee can do so with lower dissipative costs than a comparable amount of collateral. In this intermediate

case, borrowers who have significant though insufficient wealth to support a guarantee-only credit contract may be offered and accept a credit contract in which their guarantee substitutes for some amount of collateral value. In terms of the models developed in this paper, contracts in the $\{i, C, G\}$ space are most likely to arise in situations where the costs of taking, maintaining, and liquidating collateral assets costs, δ_1 , δ_2 and δ_3 are comparatively large relative to the loan amount and the owner-guarantor has significant outside net worth relative to the loan amount.

The Effect of Monopolistic Credit Markets on the Optimal Debt Contract

The contracting models employed in this essay characterize the SME intermediated credit market as one of perfect competition. While these credit markets in the US tend to be competitive, there are geographic areas where competition may be less than robust and there are trends in bank consolidation which warrant at least a consideration of the effects of less competitive banks on predictions of this model. Non-competitive markets will affect, in similar ways, the optimal contract results in both the collateral and the guarantee models. Below I illustrate the effect of a monopolistic credit market in deriving the optimal contract using collateral as the form of credit enhancement.

To examine the effects of a monopolistic credit market, the basic model could be recast as one in which the monopolistic lender designs a contract that maximizes its

expected profits subject to the borrower's participation constraint of non-negative expected utility gain from undertaking the project. That is,

$$Max\{i, C\}: E(\Pi_{Lender}) = p(e^*)(1+i) + [1-p(e^*)]\delta_3 C - \delta_1 \geq (1+r) \quad (M1)$$

subject to:

$$E(U_{Borrower}) = p(e^*)R - p(e^*)(1+i) - [(1-p(e^*))C - \delta_2 C - V(e^*)] \quad (M2)$$

The incentive compatibility constraint is, however, more problematic. In the competitive market, with all surplus accruing to the borrower, the equilibrium contract supports the borrower's choice of the first best feasible effort level, e_1 . This result follows from the ability of the borrower to retain the increase in expected project return that is generated by her marginal increase in effort. If the credit market is monopolistic, instead, the lender's attempt to extract all surplus in the form of a higher interest rate will reduce the borrower's marginal return to effort and thus cannot support the borrower's choice of the first-best effort level, e_1 .

This result can be illustrated by examining the incentive compatibility constraint for the choice of e_1 as the effort level. For a given contract (i, C) to support a first best effort choice, it must be that:

$$[p(e_1) - p(e_2)][(R-1) - i] + [p(e_1) - p(e_2)]C \geq V(e_1) - V(e_2) \quad (M3)$$

That is, the borrower's marginal expected return from additional effort must be at least as great as the marginal cost of increased effort. The marginal return is increasing in

collateral, but decreasing in the contractual interest rate (i). For a given level of collateral, C , an increase in the contractual interest rate will drive the borrower's return in the successful state, $[p(e_1) - p(e_2)][(R - 1) - i]$ toward zero so that they will choose the lower effort level, e_2 . The inefficient effort levels and lower societal returns on investment generated by this solution reflect the deadweight losses generally associated with market power.

Depending on the value of the parameters in the model, another contract solution may be possible at the first best effort level. This contract would be the solution to the program of maximizing the lender's profit function at the first best effort level, subject to the borrower's non-binding, expected utility participation constraint at the second best effort level and the binding incentive compatibility constraint that ensures that the first best effort level is chosen. In this contract, the monopolistic lender extracts surplus only to the point at which the borrower would be better off by switching to the less costly, lower effort level. The monopolistic lender will offer this contract if it provides greater expected profit than the contract designed for the choice of the second best effort level.

It is also worth noting that the monopolistic lender can unambiguously increase its return by increasing the amount of contractual credit enhancement.²⁵ An increase in the amount of credit enhancement has a positive effect on both the lender's expected profit function and on the borrower's choice of a higher effort level. This represents a specific testable implication of the model developed here that will be examined in Essay 2.

²⁵ The repayment value of collateral is, however, limited to the lesser of the collateralizable wealth or the loan amount.

Deriving a solution for credit market structures between perfect competition and monopoly is beyond the scope of the modeling framework used in this study. The analysis of the monopolistic case suggests however, that there might be a sharing of surplus by lender and borrower when competition is imperfect.

Summary and Implications

This essay has shown that a personal guarantee is a more efficient form of credit enhancement than collateral when the borrower has sufficient outside wealth to fully secure the loan's repayment. This follows from the lower dissipative costs associated with guaranteeing a loan which lowers the deadweight welfare losses relative to collateral, lowers the interest rate charged to the borrower, and encourages the borrower to supply an optimal level of effort. This analysis suggests that owner wealth is an important element in the allocation of credit in the SME credit market and that relatively wealthy business owners are able to obtain lower cost debt capital for their businesses than are business owners who are more wealth constrained.

This main result follows directly from two key modeling assumptions: 1) there are lower transactions costs associated with writing a guarantee than in designating specific assets to serve as collateral, and 2) owner-borrowers bear lower costs when liquidating personal wealth than lenders face when they liquidate collateral. These two assumptions are common in the literature, but there are some loan types for which they may not apply. In the case of vehicle loans or leases, for example, transactions costs associated with

collateralization are negligible and specialized or captive auto lenders are likely to be more efficient in liquidating vehicles than the borrower.

The modeling assumptions made in this essay, therefore, correspond most closely to short-term working capital finance such as provided by lines of credit. In these loan types, the “project” generally involves the acquisition of inventory and/or accounts receivable in order to make additional sales at a reasonably well defined profit margin. The fungible or intangible nature of the assets acquired with loan proceeds engenders high costs of collateralization and substantial diminution in value if liquidated by the lender. Further, the outside net worth of the business owner is likely to be more stable over the one-year time frame for which lines of credit are committed than over the life of loans made for real estate or equipment acquisition.²⁶

For these reasons, in Essay 2 of this dissertation I examine four empirical implications of this model on a sample of lines of credit that small businesses secured from their lenders in 2003. The first, and most direct, implication is that the probability of using a guarantee rather than collateral will increase as the owner-borrower’s net worth increases relative to the loan amount. This effect should be greatest for lines of credit where there is ample opportunity for moral hazard. A second, and closely related, implication is that at intermediate levels of owner wealth it will be optimal for loans to be secured with both collateral and personal guarantees. The last two implications focus on the higher costs that are associated costs with using collateral rather than guarantees.

²⁶ A conceptual way to incorporate the effect of volatility of owner wealth within the context of this model would be to increase the level of owner wealth at which the guarantee-only contract becomes feasible to, for instance 2 or 3 times the loan amount.

First, to the degree these costs are fixed in amount, the analysis predicts that guarantee enhancement would be particularly advantageous for smaller lines of credit. Finally, the model predicts that the guarantee will become more attractive relative to collateral when the loan period is shorter, and less attractive when the term is longer and the borrower has a longer horizon over which to pay the fixed costs associated with collateral.

A final, important modeling choice was to characterize the intermediated SME credit market as being perfectly competitive. While the intermediated SME credit market in the US tends to be competitive, there may be geographic market areas where competition is lacking. The modeling framework employed in this essay to derive optimal credit contracts under perfect competition does not neatly accommodate cases of imperfect competition or monopoly where some surplus would be expected to accrue to the lender. The framework does, however, suggest that less competitive credit markets would generate inefficient effort levels and lower societal returns on investment. This result suggests another rationale for regulatory efforts to maintain competitive conditions in the intermediated credit markets on which small businesses depend for external debt capital.

The principal result of this essay — that an owner's wealth is an important element in determining whether a project will secure funding in the small business credit market — represents an potentially important impediment to the key efficiency condition that capital should be allocated based only on expected project returns. The prospect of this market failure, moreover, suggests that policy interventions could improve of the

private small business loan market. The most obvious intervention here is that the general public provides guarantees for loans so that projects with high expected returns that are owned by entrepreneurs with low levels of wealth can be funded at low cost. Such guarantees are already available in the U.S. through programs in the Small Business Administration of the Department of Commerce. The analysis here provides both a justification for the existence of such programs as well as a theoretical framework that can be used in future work to assess whether the program is socially beneficial.

Table

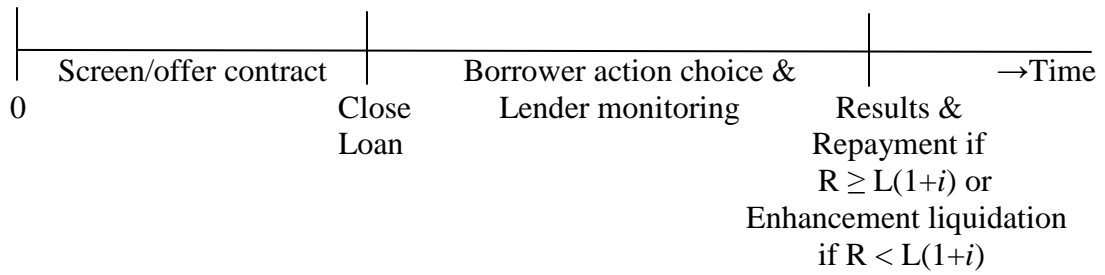
Table 1.1. Estimated Prevalence of Lead Line Enhancement Structures: Limited Liability Firms

Enhancement Structure	Proportion	Std. Err.	95% Confidence Interval	
No Enhancement	0.210	0.019	0.173	0.246
Collateral only	0.119	0.014	0.091	0.147
Collateral & Guarantee	0.303	0.020	0.264	0.343
Guaranty only	0.368	0.021	0.326	0.410

Notes: Column two reports the estimated proportions of enhancement structures on lines of credit with lead banks for the subpopulation of MSEs that are organized with limited liability. The estimates are based on a weighted sample of 1326 observations from the 2003 Survey of Small Business Finances.

Figure

Figure 1.1. Credit Contracting Time Line.



Source: See text.

CHAPTER II

ESSAY 2 - THE EFFECT OF OWNER WEALTH ON THE FORM OF EQUILIBRIUM CREDIT ENHANCEMENT

Abstract

The ubiquitous presence of collateral requirements in small business credit contracts is well documented and its use is the subject of a rich theoretical and empirical literature. However, surprisingly little attention has been paid to the pervasive and growing use of owner guarantees as an alternative or complementary form of credit enhancement. Using the 2003 Survey of Small Business finances, I extend the empirical small business debt contracting literature by studying the effect of guarantor wealth on the equilibrium enhancement structure for lines of credit. Using a multinomial logit to model the effect of guarantor wealth on the equilibrium enhancement structure, I find that increasing owner wealth results in an increased likelihood that a line of credit will be enhanced with only a personal guarantee and a decreased likelihood that the line of credit will be secured with collateral. This finding is consistent with the theoretical predictions of Essay 1 and robust to re-estimation using an ordered probit model. These results suggest that owner wealth plays a larger role in the allocation of credit in the small businesses credit market than has been indicated by previous research. Further, the impact of owner wealth on the allocation of debt capital creates a market failure that policies, such as the Small Business Administration's loan guarantee program, can mitigate.

Introduction

Large publically traded corporations typically raise external debt capital by issuing debt claims directly to investors. The risk associated with the promised repayments is summarized in credit ratings provided by one or more debt rating agencies. Rating agencies, in turn, have access to a wealth of publicly available information on the operations, finances, and competitive standing and prospects of these borrowers. In this so-called “direct” credit market for highly transparent borrowers, borrowing contracts are generally unsecured, the promised yield increases monotonically as the risk rating increases and the promised yield varies significantly over the range of risk ratings.²⁷ This direct market for raising external debt capital contrasts sharply with that faced by small, privately held firms.

Credit markets involving small to medium sized enterprises (SMEs) operate in a highly opaque environment in which informational problems abound and in which the effect of transactions costs is magnified by the small size of most transactions. SMEs are, almost without exception, privately owned businesses whose financial condition, results, and prospects are outside the public domain. Further, the closely held nature of vast majority of these firms is likely to cause confounding of a firm’s profit function with the utility function of its ownership. These informational problems can lead to a failure of price, in the form of interest rates, to balance supply and demand efficiently. Theorists have shown that increases in the contractual interest rate offered on loans have two

²⁷ From 1996 to 2003, the interest rate spread between Aaa rated corporate bonds (the lowest risk level) and Caa rated bonds (the highest risk rating not in not default) averaged 12.38%. This spread increased steadily from 1996 through 2002 and then fell appreciably in 2003 and 2004.

perverse effects in credit markets with informational asymmetries. The adverse selection effect increases the risk level of firms seeking credit. The moral hazard effect increases ex-post incentives for borrowers to shirk, to undertake riskier investment projects and to under report cash flows or divert business assets to personal use. Both these effects make price alone, in the form of the contractual interest rate, an inefficient mechanism for allocating credit in the SME credit market.

In face of these informational and transactions cost problems, SMEs obtain external debt capital indirectly by contracting with financial intermediaries, primarily commercial banks.²⁸ These financial intermediaries specialize in obtaining and processing private information on small business borrowers and in the design, execution and monitoring of credit contracts in the dual space of interest rates and credit enhancement. While marketable debt claims issued by public companies are generally unsecured and offer a wide spectrum of promised yields based on their risk ratings, debt contracts involving privately-owned, small to medium sized businesses are frequently characterized by credit enhancement as a key term in the credit agreement and a limited range of promised interest rates. Credit enhancement, in the form of collateral, has been shown to improve the efficiency of credit markets characterized by informational opacity and to ameliorate the attendant problems of adverse selection and moral hazard.

Credit enhancement provides the lender with an alternative source of potential repayment in states of the world where the borrower's cash flows are insufficient to meet

²⁸ Using the 2003 Survey of Small Business Finances, Prager and Wolken (2008) estimate that 60% of all external credit to SMEs is provided by commercial banks.

contractual principal or interest payments. If the borrower fails to make timely payment of principal or interest to the lender, the borrower is said to be in default. In the case of default, the lender can then seek repayment by accessing the source of the credit enhancement. Credit enhancement smoothes lender returns across states of borrower performance and thus “reduces the risk of lending.”²⁹ Its power, however, arises from the symmetric nature of payoffs in the credit contract. By smoothing returns to the lender, credit enhancement accentuates the difference in borrower returns across states. This increased cost of default to the borrower is the basis for theories that rationalize the use of collateral to mitigate problems of adverse selection, moral hazard, and asymmetric beliefs about the degree of business risk between the borrower and its lender.

There are two primary forms of credit enhancement in SME debt contracts: collateral and personal guarantees from the business ownership. Collateral consists of specific assets in which the lender is granted a security interest. In the event of borrower default under the loan contract, the lender may pursue ownership of and then liquidate pledged assets to obtain loan repayment. A guarantee from the business owner, in contrast, conveys no interest in specific assets. Rather, the guarantee creates a contingent claim against the guarantor’s general net worth. In the event of loan default by the borrowing business, the guarantee provides the lender with an unsecured claim against the personal net worth of the business owner(s).

Despite the extensive financial economics literature that studies debt contracting and the use of credit enhancement, there is a paucity of studies addressing the use of

²⁹ Avery et al (1998)

guarantees. Theoretical works have focused exclusively on collateral when showing how credit enhancement can mitigate informational asymmetries between the lender and SME borrower. To my knowledge, Essay 1 in this dissertation is the first theoretical work that studies the personal guarantee as an alternative enhancement device to collateral. The analysis in Essay 1 shows that a guarantee is a more efficient enhancement device than collateral if the guarantor's outside net worth is sufficiently large relative to the loan amount. This result obtains because transactions and other dissipative costs are lower for guarantees than for collateral and are incurred only if default and liquidation occur.

In this essay, I test the predictions of Essay 1 using data drawn from the Federal Reserve's 2003 Survey of Small Business Finance. The loans in the sample are lines of credit with the lead bank of 1224 small businesses who operated under limited liability. In the analysis I use a multinomial logit model to estimate the determinants of four different enhancement alternatives: guarantee only, collateral only, guarantee and collateral, or no enhancement. The model assesses how the choice among these are related to a rich set of firm, lender, relationship loan and owner covariates, including the outside net worth of the primary business owner and the amount of the loan commitment. The main finding is consistent with the prediction of Essay 1 — the propensity to use a personal guarantee rather than collateral (or both collateral and a personal guarantee) increases with the firm owner's wealth. I also find, as suggested by the analysis of Essay 1, that the probability of enhancing a loan with only a guarantee is lower in non-competitive banking markets.

The remainder of this paper is organized as follows. *Background and Literature* briefly discusses the differences between collateral and guarantees and reviews the existing empirical literature that investigates when and how they are used. *Data, Variables, and Sample Restrictions* discusses the data set, characteristics of the sample observations and the variables used in estimations. *The Empirical Model* develops the empirical model. *Empirical Results From the Multinomial Logit Model* presents and interprets primary empirical results. *Post-estimation Specification Testing and a Robustness Test* reports on post-estimation specification tests and the results of a robustness test using an ordered probit specification. *Summary* summarizes the main results and implications of the essay.

Background and Literature

Outside creditors have great difficulty assessing the future cash flows, the financial valuations and the management capabilities of small, privately-owned firms. For this reason firms like this generally borrow from financial intermediaries that assess their requests for credit and monitor their behavior at significant cost. In this environment, a range of tools called credit enhancements are available to mitigate the impact of private information and reduce the inefficiencies and high costs of credit associated with them. The primary tools for credit enhancement are collateral and guarantees. I provide an extended discussion of the differences between these mechanisms in Essay 1 of this dissertation, and the reader should consult that discussion

for details about the two forms of enhancement. For purposes of this essay it will be sufficient to understand that **collateral** involves the legal pledging or granting of a security interest in a specific asset to the lender, while a **personal guarantee** represents a contingent claim on the guarantor's net worth. These two devices enhance the security of a loan because the lender can minimize or avoid losses in the event of a default by liquidating the collateral that was pledged or requiring that the guarantor surrender his personal wealth.

In addition to the predictions of Essay 1, the empirical analysis of the choice between guarantees and collateral presented here is motivated by the simple fact that the use of both devices is ubiquitous in the credit market that serves small-to-medium enterprises (SME). The more recent empirical literature distinguishes between two types of collateral, inside and outside, based on the entity that owns the collateral assets. Inside collateral consists of assets such as production machinery or short-term investments owned by a manufacturing company that are pledged to a lender as credit enhancement for a business loan. Outside collateral consists of assets owned not by the borrowing firm but by a third party which are used to collateralize a loan to the business. In the small business market, this third party is invariably the firm's owner(s). Examples of outside collateral in the SME credit market would include marketable securities or a personal residence owned by the business owner pledged to a bank as credit enhancement for a loan made to the business. Leeth and Scott (1989) report that over 60 percent of the

small business loans in the National Federation of Business surveys in 1980 and 1982 had some form of collateral. Using data from the Federal Reserve's Survey of Terms of Bank Lending, Berger and Udell (1990) find that almost 70 percent of US commercial and industrial loans were made on a secured basis. Researchers using small business loan data from Japan, Germany, Argentina, Italy, and Belgium find similar or greater rates of collateral incidence.

The two primary types of credit enhancements, collateral and guarantees can be used individually, in combinations or not at all. Table 2.2 shows the estimated distribution of the four mutually exclusive enhancement structures for lines of credit that limited liability SMEs maintained with their lead bank in the 2003 SSBF. This essay seeks to expand our understanding of factors, most notably owner outside net worth, leading to this heterogeneity of enhancement structures. It turns out that there has been very little previous empirical research on the use of personal guarantees by small businesses. Therefore, I first examine the empirical literature on the use of collateral in SME credit contracts. This literature highlights some of the definitional problems and data limitations in both literatures.

Review of the Empirical Literature on Collateral

Despite the longstanding and robust attempts of theorists to explain the ubiquitous use of collateral in the SME credit markets, empirical studies of collateral have been

slower to develop. This is most likely due to a paucity of suitable data sets. To support empirical study of collateral use, data sets must contain not only extensive information on complex borrower, owner, lender, loan, collateral, and debt contract characteristics, but also sufficient usable observations to enable efficient estimation in the face of an arguably complex data generating process. Studies of collateral use in the US have almost exclusively used the National Survey of Small Business Finances, which was first available in 1992. The more recent European studies have generally used (non-random) sets of individual bank credit files or even researcher surveys to generate data.

Empirical studies of collateral have been motivated by one of two fundamental research agendas. The first seeks to identify the relationship between firm or loan risk and the use of collateral. These studies seek evidence for or against the negative risk/collateral correlation predicted by adverse selection theories of collateral use. The second research agenda seeks to find meaningful effects of borrower-lender relationships on the propensity for collateralization. These studies seek to identify the degree to which relationship surplus is captured by borrowers in the form of lower collateral requirements and, hence, lower dissipative costs. Jointly these studies comprise the literature on determinants of collateral use.

Regardless of the research paradigm motivating the study, empirical studies of collateral have, until recently, employed a consistent, reduced form approach. Researchers have generally used single equation models to examine whether various combinations of borrower, owner, lender, relationship, loan, and contract characteristics

can explain whether or not collateral has been used to enhance loans. In general, when classifying observations no distinction is made between inside or firm-owned collateral and outside or owner-provided collateral.³⁰ These studies also differ from each other in important ways — differences in sample restrictions on loan types, differences in the set of explanatory variables, and differences in data sets. The observational units in these studies are loan (primarily line of credit) contracts and are assumed to represent equilibrium positions between credit demand and credit supply. These are, therefore, reduced form models. With few recent exceptions, the models have been estimated as logit, probit, or linear probability models.

These studies find, on balance, that collateral use is positively correlated with the risk of the loan and of the borrower. These findings are at odds with well-known theoretical predictions of credit contracting under adverse selection.³¹ Under adverse selection, higher risk borrowers, for whom the expected cost of providing collateral is relatively high, will select contracts with high interest rates but pledge no collateral. Conversely, low risk firms, that can offer collateral at relatively low cost, will select contracts with low interest rates and collateral. This prediction has been tested by examining whether ex-ante risk measures affect the propensity for collateral to be included in the credit contract. Leath and Scott(1989) use data from the 1980 and 1982

³⁰ The more recent empirical literature distinguishes between two types of collateral, inside and outside, based on the entity that owns the collateral assets. Inside collateral consists of assets such as production machinery or short-term investments owned by a manufacturing company that are pledged to a lender as credit enhancement for a business loan. Outside collateral consists of assets owned not by the borrowing firm but by a third party which are used to collateralize a loan to the business. In the small business market, this third party is invariably the firm's owner(s). Examples of outside collateral in the SME credit market would include marketable securities or a personal residence owned by the business owner pledged to a bank as credit enhancement for a loan made to the business.

³¹ Coco, G. (2000) provides a comprehensive review of this literature.

membership surveys by National Federation of Small Business and find firm age, a proxy for decreasing firm risk, is negatively related to the prevalence of collateral use. Other studies that use firm age as a risk proxy and find a positive relationship between risk and collateral include Berger and Udell (1995), Cowling (1999) using English data, Degryse & Van Cayseele (2000) using Belgian bank credit files, and Hernandez-Canovas and Martinez-Salano (2006) using survey data from Spanish SMEs. Voordeckers and Steijvers (2006), however, find a positive relationship between firm age and collateral after controlling for relationship measures in a sample of loan contracts from the credit files of a large Belgian bank. Several studies using the 1988 or 1993 SSBF, Berger and Udell (1995), Chakraborty and Hu (2006), and Brick and Palia (2007) use financial leverage as a direct measure of firm risk. All find a positive relationship between financial risk and collateral. Finally, using proprietary US data, Berger and Udell (1990) and Booth (1992) find a positive relationship between the risk premium and the use of collateral.³²

Empirical results on the impact of borrower-lender relationship strength on the propensity to include collateral in the credit contract are less clear. Peterson and Rajan (1994), using the 1988 SSBF, find that relationship duration has no effect on collateral. Berger and Udell (1995), using the same data, find that relationship duration decreases the likelihood of collateral for lines of credit but not for other loan types. Chakraborty and Hu (2006), using the 1993 SSBF, find that relationship duration reduces the probability that collateral will be used for lines of credit. This relationship is reversed for

³² Both these studies use the risk premium (the spread over the risk free rate for a loan or similar duration) as a dependent variable and collateral as a left hand side variable.

term loans. Studies using European data generally find that relationship duration reduces collateral requirements. Hernandez-Canovas and Martinez-Salano (2006), however, find that relationship duration increases the probability of collateral use in their sample of Spanish SMEs.

Recent studies have begun to consider issues of simultaneity in contracting terms and have begun to incorporate distinctions between inside and outside collateral. Cressy and Toivanen (2001) use two-stage least squares to estimate a system of three equations for determining collateral, the interest rate, and loan amount in the credit contract for a sample of loans from a large U.K. bank. In the collateral equation, they find that loan duration is positively associated with collateral but firm risk has no effect. Hernandez-Canovas and Martinez-Salano (2006) use a traditional model but study the effects of firm and relationship characteristics on outside collateral for a sample of Spanish SMEs. Voordeckers and Stijvers (2006) use data from credit files of a Belgian bank to estimate an ordered probit and continuation ratio logit model with collateralization and the form of collateral (inside or outside) as dependent variables. Finally, Brick and Palia (2007) using the 1993 SSBF, use two-stage least squares to estimate a system of three equations for determining the loan rate and the use of outside and inside collateral.

The empirical literature on collateral has generated considerable heterogeneity in results. Perhaps this should be expected given the complexity of the process under study, the differences in control variables across studies and data sets, the differences in legal and institutional structures in countries where data sets have been garnered, the potential

for simultaneity in the terms of the credit contract and, perhaps, a general inability or failure to distinguish between types of credit enhancement; collateral and personal guarantees. This later issue has, however, begun to be addressed.

Review of the Empirical Literature on Guarantees

Despite the pervasive use of personal guarantees as a form of credit enhancement in the SME credit market, there are few empirical studies of guarantees. Three studies represent the development of this empirical literature. Though it did not distinguish between personal collateral and personal guarantees, Ang et al. (1995) was the first to specifically study the use of outside collateral and/or personal guarantees as a credit enhancement device. Avery et al. (1999) extends this work by treating outside collateral and personal guarantees as distinct enhancement devices. Voordeckers and Steijvers (2006) study determinants of enhancement structures when options include no enhancement, inside collateralization, and the use of outside collateral and/or personal guarantees. Like Ang et al. (1995), this last paper does not distinguish between outside collateral and personal guarantees.

Ang (1995) provides the first empirical look at credit enhancements other than business collateral in small business credit contracts. This strictly descriptive study uses data from the 1988 Survey of Small Business Finances (SSBF) to explore the degree to which enhancements in the form of “personal commitments” are used in various lending circumstances. Ang was the first author to explicitly differentiate between credit enhancements that take the form of business collateral and those that represent a granting

of “personal commitments” either by pledging personal assets or granting personal guarantees. The analysis established that organizational form, the S-Corporation in particular, is an important determinant of personal commitment use. In concert with the majority of collateral studies, there was increased use of personal commitments to secure loans made to smaller firms and to unprofitable or highly leveraged (risky) firms. This important pattern suggests that the widespread use of personal commitments in SME lending undoes much of the separation of business and personal risks in the SME credit market thought to have been afforded by limited liability. Ang et al. reports two final results of particular importance here: 1) personal commitment use is far most prevalent for lines of credit than term loans and 2) the pervasive use of personal commitments indicates that personal wealth may play a strong role in the allocation of credit to small businesses.

Avery et al. (1998) extends the pioneering work of Ang et al. in several important ways. First, by using a regression methodology, they are able to study the effects of owner, lender, and additional loan characteristics on the propensity for personal commitments to appear in the credit contact. Second, they study personal guarantees as a distinct form of credit enhancement. Lastly, when assessing the economic importance of personal commitments, they supplement the metric of incidence of use with one related to the dollar amount of financing associated with personal guarantees and outside collateral. Using 1988 and 1993 SSBF data, as well as 1989, 1991, and 1993 Survey of Consumer Finances data, Avery et al. report a number of findings. Like the results reported in Ang et al, personal commitment use is found to be far more prevalent for corporations than for

non-limited liability firms. The incidence of personal commitments generally and of personal guarantees specifically was found to have increased from 1988 to 1993.

Personal commitments were found to substitute for business collateral for lines of credit but often found to complement inside collateral for other loan types. Avery et al. found that loan size and the likelihood of a guarantee were positively correlated for all loan types other than mortgage loans. Guarantee use was particularly prevalent for lines of credit and for loans provided by commercial banks. Finally, using the SCF data to investigate the observation in Ang et al., that personal wealth may play a significant role in the allocation of credit to small businesses, Avery et al. found no systemic relationship between owner wealth and the incidence of personal commitments.³³

The most recent contribution to this literature is a 2006 study by Voordeckers and Steijvers. Using proprietary data from 234 credit files from loans to medium sized firms made by a large Belgian commercial bank, the study is the first to use a polychotomous dependent variable to study determinants of multiple enhancement structures. The first-stage model is an ordered probit with a trinomial enhancement choice: 0 if there is no enhancement, 1 if only business collateral is used, and 2 if any type of personal commitment (personally-owned collateral or a personal guarantee) is included in the debt contract.³⁴ The second-stage uses a continuation-ratio logit model to identify determinants of business collateral versus personal commitments conditional on having chosen to use some form of credit enhancement. Results from the continuation-ratio logit

³³ The SCF data was used since the SSBF data did not contain data on owner wealth. While the SCF did contain owner wealth data, it did not contain data such as the amount of the business loan.

³⁴ This choice includes cases where only personal commitments are used and where personal commitments are used in conjunction with business collateral.

model suggest that the presence of trade credit, competitive bidding of the loan, the size of the loan, and the age of the firm each tend to increase the use of business collateral rather than personal commitments. Firm asset size tends to favor the use of personal rather than business forms of enhancement. The study does not distinguish between enhancement in the form of a personal guarantee and enhancement in the form of personal collateral.

Data, Variables, and Sample Restrictions

This essay uses the public version of the 2003 Survey of Small Business Finances (SSBF) as the sole source of data. The 2003 survey is the fourth and final in a series of four surveys directed and underwritten by the Board of Governors of the Federal Reserve System. These surveys were conducted at five-year intervals beginning in 1988. The 2003 survey provides detailed data on 4,240 independent, domestic, for profit, non-financial, non-agricultural businesses with fewer than 500 employees. The four SSBF surveys are the only publicly available sources of detailed data on the finances and financial service use of US small businesses. They contain extensive information on firm characteristics, ownership characteristics, firm finances, financial service usage, and the terms of credit facilities. The survey also contains data on the institutions providing financial services and characteristics of the business relationship between the firm and its suppliers of financial services.

The 2003 survey is a nationally representative sample of approximately 6.3 million US independent small businesses in operation as of December 31, 2003. Sampling is a stratified random sample. Strata consist of both rural and urban locations

within each of the nine census regions, as well as four employee size categories. Firms with 20 to 499 employees are oversampled to facilitate research focusing on larger firms and throughout the essay estimates of population statistics are calculated by weighting observations with the inverse of the probability of being selected for the sample.

Standard errors for estimates of population statistics require adjustment for clustering at the urban/rural census region level. The source for sample selection was the Dun's Market Identifier Files, which tends to under-represent the newest and smallest firms. Of particular importance to this essay, the 2003 survey also contains information on the outside, non-business, net worth of the principle business owner. This data on owner wealth was not available in the earlier 1988 and 1993 surveys that were used by Ang et al. (1995) and Avery et al. (1998).

Less than 1.8 percent of all survey values were missing with thirty percent of observations having no missing values and sixty-five percent of the observations missing less than 1 percent of responses. In almost all cases, values for missing responses have been imputed via randomized regression.³⁵ The Federal Reserve project team also checked data for internal consistency and for overly influential cases and outliers, making data edits where clearly appropriate for the sample as a whole.

Sample Restrictions and Missing Values

Following Berger and Udell (1995) and most of the subsequent related empirical literature; I study debt contracting features of lines of credit. Lines of credit are the most

³⁵ The randomization of the imputation is captured in five separate imputations for each imputed variable, which facilitates more accurate estimation of standard errors.

common and important source of external financing for small businesses.³⁶ Lines of credit also exhibit the greatest variation in collateral types and in enhancement structures. Table 2.2 estimates the distribution of the four enhancement structures for lines of credit obtained by all limited liability firms from their primary bank. The point estimate of this distribution is as follows: 33 percent of lines of credit are enhanced with only a guarantee, 15 percent are enhanced with only with collateral, 26 percent are enhanced with both collateral and a guarantee, and 25 percent have no enhancement. This contrasts with the other forms of loans: mortgage loans, equipment loans, and vehicle loans which are defined by both their purpose and collateral type.

Lines of credit are generally renewed annually with terms updated to reflect both changing borrower and credit market conditions. Thus, lines of credit have the further advantage of generally being committed for a common one-year period so that the contracting variable of loan maturity is consistent across observations. Finally, the revolving nature of borrowing under lines of credit affords greater opportunity for moral hazard in the forms of project substitution or asset diversion than occurs for single advance loans to purchase specific assets. Loan disbursement procedures associated with these latter loan types: mortgage loans, equipment loans, and vehicle loans, insure that loan proceeds are used for their intended purpose. In cases where firms have lines of credit with multiple lenders, I use the one with the firm's lead bank and add an indicator

³⁶ 1910 of the 4240 firms in the 2003 SSBF have a line of credit. Outstanding line of credit debt financed 14.5% of small business assets in the 2003 survey with average usage of only 46% of committed lines. The second largest source of outside funds was trade credit which funded 13.6% of assets. Table 1.1 shows all sources of capital for SMEs in the 2003 SSBF and demonstrates the importance of lines of credit in the SME credit market.

variable for the presence of other line lenders. The existence of multiple line of credit providers creates additional incentives for collateralization (Haroff and Korting, 1999).

Both Ang et al. (1995) and Avery et al. (1998) find that the presence of personal commitments (the pledge of personal collateral and/or the provision of a personal guarantee) in the enhancement structure is far more prevalent when firms are organized with limited liability. Businesses organized as sole proprietorships or general partnerships do not distinguish between assets or liabilities of the business and those of the proprietor or general partner. Hence, loans to businesses organized as proprietorships or general partnerships are implicitly “guaranteed” by the proprietor or general partner, and the execution of a formal guarantee agreement for these firms is generally redundant. I therefore limit the observations to those where the organizational form of the business limits the liability of the business owners for debts incurred by the firm.³⁷ In these cases, the choice to include a guarantee in the enhancement structure is an overt choice to undo the separation of business and personal risks afforded by limited liability.

In the 2003 SSBF, 1634 firms have lines of credit with their primary source of financial services. The self-identified primary source for 22 of these observations was an individual. These and 2 other observations that identified a government agency as their primary line of credit source were dropped from the sample. Of the remaining 1612 observations, 286 were firms organized without limited liability and were also dropped from the estimating sample. This leaves 1326 firms in the 2003 SSBF that are organized

³⁷ The organizational forms which afford limited liability to their owners are : section S and C corporations, LLCs and LLPs.

with limited liability and that have line of credit with a lead source that is a private institution. These observations were used to estimate the population distribution of enhancement structures for this frame reported in Table 2.2. In the regression sample, 4 observations have missing values for either leverage or return on sales and 98 observations had missing values for owner outside net worth. The final estimating sample for the regression analyses thus has 1224 observations.

Variables

The extensive number of variables in the 2003 SSBF provides the researcher with an extensive set of covariates that can be expected to influence the equilibrium choice of enhancement structure. To organize the included variables, I categorize them into four groups: characteristics of the firm, characteristics of the firm's ownership, characteristics of the lender, and characteristics of the relationship between the firm and its lead bank. Past studies have, in general, used a more parsimonious set of right hand side variables.

Firm characteristics can be expected to affect the enhancement structure though at least two mechanisms: the type of assets available to serve as inside collateral (which affects the dissipative costs of collateralization) and indicators of relative firm risk. The amount and type of assets available to serve as collateral and the transactions costs associated with the granting and perfecting of a security interest therein can be expected to influence the trade-offs between collateral and guarantees in the equilibrium contract. As mentioned in the literature review section, the effect of firm risk on collateralization has been empirically studied with the mass of the evidence supporting a positive

correlation between firm risk measures and the propensity for collateralization.³⁸ The vector of firm characteristics that I employ consists of eight indicators for industrial classifications, the log of the age of the firm, the log of total firm assets, return on sales, leverage ratio, and an indicator for owner management. Industry classifications reflect both assets available for collateral and potential risk differentials (Cole, 1996). The age of the firm has been used as a negative risk proxy (Leeth and Scott, 1989). The size (in assets) of the firm influences the amount of assets available to collateralize debt and is also a negative risk proxy. The return on sales and leverage ratios are direct measures of observable firm risk (Berger and Udell, 1995). The owner managed indicator has not been traditionally used in the literature. I include it as a marker for risks associated with moral hazard arising from the confounding of the firm's profit function with the owner's own utility function.

Owner characteristics are particularly important to the credit enhancement structure for SME which are overwhelmingly private and closely held business.³⁹ As private, often family-owned and owner- managed businesses, the ability, interests, and resources of the owners are of consequence for the operations and structure of the business and are likely to influence the enhancement structure in several distinct ways. Of central interest in this essay, is the role of owner wealth on the propensity for personal guarantees to be used as the sole form of credit enhancement. The owner wealth variable is constructed for the primary owner as the log of the sum of equity in personal

³⁸ However, none of these studies have distinguished between collateral and personal guarantees as distinct enhancement devices.

³⁹ Table 2.3 shows that 75% of the firms in the estimating sample are family owned and 86% are managed by a major owner of the business.

residential plus other personal assets less the value of his/her investment in the business. If transactions costs and utility losses of guarantees are significantly lower than those of providing collateral and owner wealth is sufficient to assure the lender of repayment under the guarantee in the event of unsatisfactory performance of the business, then the use of a guarantee rather than collateral to enhance the credit is Pareto efficient. Multiple owners, particularly if they have very different levels of outside personal wealth, may create agency problems among the partners that outweigh the relatively lower transaction costs associated with guarantees.⁴⁰

Lender characteristics can be expected to influence observed enhancement structures in two important ways. The type of lender will likely impact the incidence of collateralization. If the line of credit is provided by a specialized lender, such as commercial finance company or a securities firm, types of lenders that employ specific asset-based lending technologies, the enhancement structure can be expected to contain the correspondingly specialized collateral (Berger and Udell, 2006). For example, commercial finance companies specialize in providing lines of credit collateralized by accounts receivable and inventory, while brokerage firms specialize in providing lines secured by marketable securities. To control for the effect of differing lender types on enhancement structure, lenders are categorized as depository institutions or specialized institutions. Depository institutions include commercial banks, savings banks, savings and loans, and credit unions. While these institutions have some different characteristics, regulatory changes have served to make their behavior more homogenous in the SME

⁴⁰ See Ang et al. (1995) for further discussion of this problem

credit market. Depository institutions generally and commercial banks specifically provide the overwhelming majority of lines of credit to SMEs.⁴¹

Theory suggests that a second lender characteristic, the degree of lender competition, should have an effect on equilibrium enhancement structures. Additional enhancement improves the lender's expected return but the costs of enhancement are, in general, born by the borrower. Models of collateral assume competitive credit markets so the lender's participation constraint is binding at the zero profit level and all surpluses accrue to the borrower. To the extent that credit markets are not competitive, credit contracts may stipulate a combination of higher interest rates and, as shown in Essay 1, higher enhancement requirements. The SSBF contains a categorical variable for the degree of bank plus savings and loan deposit concentration in the MSA or county of borrower's headquarters.⁴² I use this variable as a proxy for the level of competition in the relevant credit market. If the index is 1800 or more, the market is deemed to be non-competitive; if it is less than 1800, the market is deemed to be competitive. This distinction is consistent with regulatory definitions of market concentration.

Relationship Characteristics have been shown to affect credit contract terms through two primary mechanisms. The first can be characterized as the transmission of private information regarding the risk characteristics of the borrower through repeated interactions between the borrower and the bank over time and across some services. This transmission of private information to the lender mitigates ex ante informational

⁴¹ In the 2003 SSBF, depository financial institutions provide 95% of all lines of credit

⁴² This variable is based on the Herfindahl index, which is calculated as the square of the bank and savings and loan deposit shares in each MSA or rural county.

asymmetries than can otherwise cause SME credit market failures. The second, potentially related mechanism is the reduction in marginal screening and monitoring costs afforded by debt re-contracting and by the sourcing of multiple types of debt from the same lender.

A large number of empirical studies have tested the efficacy of these mechanisms. Berger and Udell (1995) find that relationship duration is negatively related to both the stated interest rate and the propensity for collateral for lines of credit. Chakraborty and Hu (2006) find that the number of services provided by a line lender (the relationship breadth) has no effect on whether or not the line is collateralized. Haroff and Korting (1998) find that lines of credit are more likely to be collateralized as the firm deals with more lenders. To study the effects of relationship variables on enhancement structures,

I use the duration of the relationship between the lead bank and the firm and an indicator for the number of line lenders. Though not a relationship variable, I also control for the amount of the line of credit. Essay 1 shows that a guarantee-only enhancement structure become feasible only if owner outside net worth is sufficiently large relative to the amount of the loan. The line size variable is also included capture the effects of credit size in averaging down the fixed costs associated with collateralization.

Means standard errors and numbers of observations for each independent variable in the estimating sample are shown in Table2.3. The table also shows the means and number of observations for each enhancement structure. Observations with missing owner outside net worth are not included in this table.

The Empirical Model

Data Generating Process

Selection of the econometric model can be motivated by considering the process generating observations in the data. Observations are equilibrium credit contracts for lines of credit between limited liability firms and their lead bank. The terms of these line of credit contracts are consequences of the intersection of borrower demand functions and lender supply functions for lines of credit. Though the supply and demand functions for these small business credit lines cannot be identified, the process generating these credit contracts can be conceptualized as follows: Certain small privately and closely held firms seek short-term external debt financing in the form of lines of credit. These firms seek offers from competing lenders in the intermediated loan market.⁴³ Offers consist of contracts in the $\{i, E\}$ space where i consists of fees and the interest rate on borrowings and E consists of required credit enhancement. Credit enhancement can take one of four forms: no enhancement, collateral, a guarantee from the business owner and, finally, both collateral and a guarantee. The firm accepts and closes the contract offer providing the firm/owner with the greatest expected utility or, alternatively, with the greatest expected surplus from undertaking the financed investment project. We observe the enhancement structure of the accepted equilibrium contract. In cases where the borrower's demand for a line of credit does not generate an offer or if no offer is acceptable, there is no

⁴³ Even if the borrowing firm does not formally request offers from other potential lenders, the borrower could do so. Knowing that this is a credible "threat," the lead bank's offered contract will, in a competitive credit market; attempt to maximize borrower utility subject to the lead bank's expected profit function (participation constraint).

equilibrium contract to observe and these firms are excluded from the estimating sample. These exclusions may be a source of selection bias and are discussed in *Post-estimation Specification Testing and a Robustness Test*.

The contract term which we observe is the form or nature of the enhancement structure rather than its amount. Given the dollar amount of the committed line of credit, the amount of the enhancement depends on both future asset values and the costs of asset liquidation. Both of these variables are random and are, ex-ante, unobservable. The enhancement structure — guaranteed, collateralized, both or neither — is an observed category describing alternative types or forms of credit enhancement in the credit contract. In this environment, there is no systematic ordering to the forms of enhancement;⁴⁴ rather, they represent four mutually exclusive and collectively exhaustive categories of credit enhancement. This makes the chosen enhancement structure a polychotomous variable taking one of four values (0, 1, 2 or 3), depending on the observed form of credit enhancement associated with the firm's line of credit agreement with its lead bank.

The contracting process is a complex one. Contracts offered and selected will depend on a host of firm, borrower, lender, loan, market, and relationship characteristics. Firm characteristics include industry, size, age, legal structure, and financial condition. Lender characteristics may include type of institution, its financial condition, the degree of experience it has with the borrower's industry and market, and the lender's size and

⁴⁴ Later in the paper I estimate an ordered model as a robustness check. To do this I offer a plausible dimension for ordering the alternative enhancement structures.

organizational structure. Owner characteristics affecting the contract include the number of owners, the nature of the relationships among the owners (if in the same family for example), the “character” and reputation of ownership, the degree to which ownership is active in management and, of primary importance to this study, the wealth of the primary owner outside his/her ownership interest in the borrowing business. Given that observations are limited to a single loan type (line of credit) that is generally offered for a 12-month period, the primary loan attribute outside of the contracting variables is its size. Credit market characteristics affecting the contract include the degree of lending competition and time in the credit cycle at which the line was granted. Finally, characteristics of the relationship between the borrower and the lender — its duration, scope and degree of exclusivity — are likely to affect the amount of surplus between the lender and borrower and its allocation between them.

Notably, all of the variables above describe characteristics of the contracting parties, their relationship and the credit market in which the contracting takes place. None of the variables describes attributes of the enhancement structures themselves. These and other characteristics affecting enhancement choice are not observed.⁴⁵ The cumulative effect of the unobserved characteristics on the equilibrium enhancement structure must be captured in an error term.

⁴⁵ The absence of variables capturing characteristic of the alternative enhancement structures will rule out the use of some otherwise attractive estimators.

Derivation of the Multinomial Logit Estimator from a Random Utility Model for Enhancement Choice

The competitive contracting process generating the data provides a framework from which we can develop the observed enhancement structure as the outcome of a random utility model. The competitive financial intermediary, subject to its own zero expected profit participation constraint, designs a loan contract that maximizes the borrower's expected return on an investment project financed with a line of credit. The borrower's expected return or utility from the project depends, in part, on the interaction of characteristics of the borrower with the form of credit enhancement in the credit contract. The lender must choose among a set of four mutually exclusive and collectively exhaustive enhancement structures denoted by $j \in \{0,1,2,3\}$ when designing the loan contract, where the borrower's expected utility from each enhancement alternative is given by $U_{ij}^* = V_j(X_i) + \varepsilon_{ij}$. U_{ij}^* is an unobserved, latent index of the expected utility that borrower i will obtain from enhancement structure j .

The utility index, therefore, is a function, $[V(.)]$ of borrower, owner, loan, and relationship characteristics contained in the data. Since the data does not contain information on the attributes of the alternative credit enhancement structures, the independent variables in the vector X are indexed by the firm, i , and not by each form of

potential enhancement.⁴⁶ ε_{ij} is an additive, random disturbance arising from unobserved factors influencing the expected utility of enhancement alternatives, errors in optimization arising from bounded rationality, and errors in measuring observed characteristics. We assume that ε_{ij} is independently and identically distributed with a type 1, extreme value (Gumbel) distribution. The CDF of ε_{ij} , $F(\varepsilon_{ij} < \varepsilon)$, is then equal to $\exp(-e^{-\varepsilon})$ and its PDF, $f(\varepsilon_{ij}) = \exp(-\varepsilon_{ij} - e^{-\varepsilon_{ij}})$.

In the data, we have an observed multinomial variable, Y_i , for the actual enhancement structure for each firm with a line of credit where:

$$Y_i = j \text{ if } U_{ij}^* = \max(U_{i0}^*, U_{i1}^*, U_{i2}^*, U_{i3}^*) \text{ or, equivalently, if } U_{ij}^* > U_{ik}^* \text{ for all } k \neq j \quad (2.0)$$

$$\text{So } Prob(Y_i = j) = Prob(U_{ij}^* > U_{ik}^* \text{ for all } k \neq j) \quad (2.1)$$

$$= Prob(V_j(X_i) + \varepsilon_{ij} > V_k(X_i) + \varepsilon_{ik} \text{ for all } k \neq j) \quad (2.2)$$

$$= Prob(\varepsilon_{ik} < V_j(X_i) + \varepsilon_{ij} - V_k(X_i) \text{ for all } k \neq j) \quad (2.3)$$

Because of the ε_{ij} are assumed to be independently distributed, the joint probability that $\varepsilon_{ik} < V_j(X_i) + \varepsilon_{ij} - V_k(X_i) \text{ for all } k \neq j$ is the product of the probabilities that $\varepsilon_{ik} < V_j(X_i) + \varepsilon_{ij} - V_k(X_i) \text{ for each } k \neq j$.

⁴⁶ Were the data such that observations consisted of alternative-specific attributes of each enhancement structure but no variation in characteristics of the borrower, the expected utility would be modeled as $U_{ij} = X_j\beta + \varepsilon_{ij}$, which would lead to the conditional logit model. Were the data such that each observation contained variation in both the characteristics of the agent and the attributes of the alternatives for each agent, the expected utility of each choice for each agent (borrowing firm) would be given by $U_{ij} = X_{ij}\beta + Z_i\theta_j + \varepsilon_{ij}$, which leads to the development of mixed or nested logit model.

So we can now write:

$$Prob(Y_i = j) = \int_{-\infty}^{\infty} \prod_{k \neq j} F(\varepsilon_{ij} + V_j(X_i) - V_k(X_i)) f(\varepsilon_{ij}) d\varepsilon_{ij} \quad (2.4)$$

which, under assumptions for F and f

$$= \int_{-\infty}^{\infty} \prod_{k \neq j} \exp(-\exp(-\varepsilon_{ij} - V_j(X_i) + V_k(X_i))) * \exp(-\varepsilon_{ij} - e^{-\varepsilon_{ij}}) d\varepsilon_{ij} \quad (2.5)$$

$$= \int_{-\infty}^{\infty} \exp(-\varepsilon_{ij} - \exp(-\varepsilon_{ij} - \varepsilon_{ij_j} (\sum_{j \neq k} \frac{e^{V_j(X_i)}}{e^{V_k(X_i)}}))) d\varepsilon_{ij} \quad (2.6)$$

Which, becomes

$$= \frac{e^{V_j(X_i)}}{\sum_{k=0}^K e^{V_k(X_i)}} \quad (2.7)$$

If we now assume that $V_j(X_i)$ is a linear combination of the observed characteristics of the i^{th} borrower so $V_j(X_i) = X_i' \beta_j$, then:

$$Prob(Y_i = j) = \frac{e^{X_i' \beta_j}}{\sum_{k=0}^K e^{X_i' \beta_k}} \quad (2.8)$$

which gives the logit form for the observed credit enhancement structure.

In this equation, the parameter vectors for each alternative, β_j , are not unique.

For any vector c with the same dimension as parameter vectors β_j , the vectors $(\beta_j + c)$

will also be a solution to this equation.⁴⁷ This indeterminacy can be solved by normalizing the set of parameter vectors by choosing one of the parameter vectors associated with an alternative, such as β_0 , as a normalizing vector and redefining the J parameter vectors as $\beta_j = (\beta_j^\circ - \beta_0)$ so $\beta_0 = 0$.⁴⁸ The alternative associated with β_0 is called the base alternative or comparison category. Though this normalization identifies the parameter vectors, it does so at a cost of complexity in their interpretation. The β_j are no longer associated solely with alternative j . Rather they reflect the non-linear effect of a change in a characteristic of the borrower on the log of the odds ratio with which alternative j is chosen rather than the base choice. This can be illustrated as follows:

$$Prob(Y_i = j|X_i) = \frac{e^{X_i'(\beta_j)}}{1 + \sum_{k=1}^K e^{X_i'(\beta_k)}} \quad (2.9)$$

Where the parameter vectors are normalized with $\beta_0 = 0$. From this we can compute J log odds ratios:

$$\ln \left(\frac{Prob(Y_{ij}=1|X_i)}{Prob(Y_{ik}=1|X_i)} \right) = \ln \left(\frac{e^{X_i'(\beta_j)}}{e^{X_i'(\beta_k)}} \right) = X_i'(\beta_j - \beta_k) = X_i'\beta_j \text{ if } \beta_k = 0. \quad (2.10)$$

⁴⁷ This can be shown by substituting $(\beta_j + c)$ for β_j and $(\beta_k + c)$ for β_k in this equation. The $e^{X_i'(c)}$ terms in the numerator and denominator will cancel out.

⁴⁸ Statistically, any alternative can be chosen as the base alternative. Changing the base category changes the parameters being estimated and, hence, their values. Since probabilities must sum to one, predicted probabilities for selection of an alternative as well as the marginal effects of a change in x_i on the predicted probabilities are, as we would hope, unaffected by the choice of the normalizing alternative.

This shows that the coefficient vector for a choice $j \neq 0$ gives the non-linear effects of a change in borrower characteristic on the odds with which alternative j is chosen rather than the base choice.⁴⁹

The difficulty of coefficient interpretation in the multinomial logit model can be further highlighted by deriving the marginal effects of the characteristics on the probability of an alternative.

$$\frac{\partial(Prob(Y_i=j))}{\partial X_i} = \left(\frac{e^{X_i'(\beta_j)}}{1 + \sum_{k=1}^K e^{X_i'(\beta_k)}} \right) (\beta_j - \sum_{k=1}^K (\beta_k Prob(Y_i = k))) \quad (2.11)$$

which depends on the parameters for the other alternatives and the on the values of the elements of X_i for both its magnitude and even for its sign.

Model Choice

Both the data generating process and its extension to a random utility model lead me to assess the effect of owner outside net worth on the equilibrium choice of enhancement structure by estimating the following reduced form multinomial model for limited liability firms with lines of credit from their lead bank:

$$Pr(y=m|x) = \frac{\exp(xB_{m|b})}{\sum_{j=1}^J \exp(xB_{j|b})} \quad (2.12)$$

⁴⁹ This expression also shows that the odds ratio for any two alternatives depends only upon the relative frequency with which those two alternatives are selected and will thus be unaffected by the addition or deletion of one of the alternatives. This *independence of irrelevant alternatives* (IIA) condition is a consequence of the assumption that errors in the random utility model are independent across alternatives. IIA is discussed further in the post-estimation testing portion of this section.

where m indicates one of the set of three mutually exclusive enhancement structures: no enhancement, collateral only, and guarantee only; “ b ” is the base or comparison enhancement structure (both collateral and a guarantee):⁵⁰ and \mathbf{x} is a vector of expanded firm, owner, lender, relationship, and loan characteristics, including the outside net worth of the primary business owner, as the variable of interest in this study.

Essay 1 develops equilibrium credit contracts in a competitive SME credit market where borrowers demand a line of credit type loan in an environment of moral hazard. In that essay, I show that the equilibrium credit contract will be enhanced with only a guarantee if the borrower has sufficient outside net worth relative to the line of credit amount. The theoretical analysis in Essay 1 would predict the coefficients on owner net worth and on the amount of the line of credit commitment in the guarantee-only comparison to be statistically significant and to have, respectively, positive and negative signs after controlling for firm, other ownership, lender, and relationship characteristics. Since the interpretation of multinomial coefficients with this number of choices is difficult at best, I will rely on graphs of the predicted probabilities for enhancement outcomes to demonstrate the *ceteris paribus* effects of increasing owner wealth and several other variables on the equilibrium credit enhancement structure.

Estimation of the model is done by maximum likelihood. The closed form of the probabilities for each of the choices is a consequence of the assumed distribution or the errors in the random utility model. The assumption that the errors are randomly drawn

⁵⁰ I used both collateral and guarantee as the base outcome for two reasons: this outcome had the second most observations and to assist in the gross interpretation of the coefficients.

from a type I extreme value distribution leads, after normalizing the estimated coefficients, to a logistic function for the choice probabilities. The resultant likelihood function is straightforward to maximize using numerical methods. Denoting the observed choice by $Y_{ij} = 1$ if alternative j was chosen and $Y_{ij} = 0$ otherwise, the log-likelihood function for N observations and J alternative enhancement structures is

$$\ln L = \sum_{n=1}^N \sum_{j=0}^J Y_{ij} \ln(\text{Prob}(Y_i = j|X_i)) = \sum_{n=1}^N \sum_{j=0}^{J-1} Y_{ij} \ln\left(\frac{e^{X_i'(\beta_j)}}{1 + \sum_{k=1}^K e^{X_i'(\beta_k)}}\right) \quad (2.13)$$

and

$$\beta^{mle} = \text{argmax}_{\beta} \left[\sum_{n=1}^N \sum_{j=0}^{J-1} Y_{ij} \ln\left(\frac{e^{X_i'(\beta_j)}}{1 + \sum_{k=1}^{J-1} e^{X_i'(\beta_k)}}\right) \right] \text{ for } \beta = [\beta_0 \beta_1 \dots \beta_J] \quad (2.14)$$

Alternative Estimators

An ordered probit will also be considered as a specification for this study. An attractiveness of this model is both its use of information inherent in the ordering of the dependent variable categories to provide more efficient coefficient estimates and its non-imposition of the IIA assumption. Use of an ordered specification, however, requires that the categorical values of the dependent variable, in this case the form of credit enhancement; represent a one dimensional ordering across categories. The ordered probit model is developed by assuming that the categories of the dependent variable are derived from a latent index for an underlying, quantifiable characteristic. For example, when using an ordered probit to estimate the effects of firm and bond characteristics on its

credit rating (AAA, AA, A BAA etc), it is straight forward to conceptualize the ratings as ordered categories derived from an underlying, latent index of default risk.

In the previous discussion of the data generating process for the four mutually exclusive enhancement structures — no enhancement, collateral only, guarantee only, and both collateral and a guarantee — these outcomes were more naturally interpreted as distinct categories rather than sequential degrees of some underlying latent index. We observe the form of the enhancement structure but not the “amount” of enhancement. There is no obvious underlying latent index from which derive an ordering of the enhancement structures. While the theoretical Essay 1 finds that guarantees can be a more efficient form of credit enhancement than collateral, this result is only obtained when the guarantor has sufficient wealth to make the collateral only enhancement structure a feasible alternative. In this model owner wealth re-orders the efficiency of the alternative enhancement structures for a given borrower in the equilibrium credit contract. This suggests the absence of an ordering based on efficiency of enhancement structures that applies to all borrowers. Given this, I conclude that an unordered, multinomial logit is the most appropriate estimator for this study.

Voorddeckers and Steijvers (2006) argue that the enhancement structures — no enhancement, business collateral, and personal commitments — are ordered by the degree to which they mitigate the moral hazard of SME lending in the Belgian banking system. In the current essay, where the choice of enhancement structure is assumed to be heavily influenced by relative transactions costs, a plausible dimension in which to order

enhancement structures may be in the degree of dissipative costs associated with their use. Based on the modeling in Essay 1, this leads to the following, highest to lowest cost ordering: collateral only, collateral and guarantee, guarantee only, and no enhancement. An ordered probit using this plausible ordering of the alternatives is estimated in *Post-estimation Specification Testing and a Robustness Test* of this essay as a robustness check for the results of the multinomial specification.

A second alternative, the nested logit, was also considered. Like the multinomial logit, this estimator can be derived from a random utility model and it possesses the computational advantage of having a closed form logit expression for the likelihood function. Moreover, unlike the multinomial logit, it can accommodate correlated errors among alternative enhancement structures. Correlations between or among alternatives are addressed by partitioning alternatives that are closest substitutes (have correlated errors) into common groups or “nests.” The choice probabilities for each alternative are then estimated as the product of the probability that a group or nest is chosen and the probability that a specific alternative is chosen conditional on the probability that the “nest” to which it belongs is chosen. If the nesting structure is properly specified, the nested logit estimator accommodates correlated errors among alternatives within a common group or nest; overcoming the problem of the independence of irrelevant alternatives assumption in the multinomial logit. To identify the probability that nests are chosen, the data must contain variables that are specific to the alternatives. The SSBF data used in this study does not contain variables that are attributes of the enhancement alternatives. It is, therefore, not possible to estimate a nested logit model.

Empirical Results from the Multinomial Logit Model

Coefficient estimates and standard errors associated with each variable and each non-base enhancement structure are reported in Table 2.4. Marginal effects of the independent variables at the means of the sample are reported in Table 2.5. As predicted by Essay 1, there is a systematic relationship between owner wealth and the observed enhancement structure. The coefficients on the log of owner outside net worth and on the log of amount of the line of credit are both statistically significant at the 5% level in the guarantee only - both collateral and guarantee comparison. The signs of the coefficients indicate that the ceteris paribus effect of increasing owner net worth, for a given line of credit commitment amount, is to increase the odds that the line will be enhanced with only collateral rather than both collateral and a guarantee. The ceteris paribus effect of the amount of the line of credit decreases this odds ratio. These directional results are mirrored in the marginal effects. The marginal effects of owner wealth and the amount of line of credit amount on the probability of a guarantee are, respectively positive and negative and are significant at the 1% level. In the both collateral and a guarantee outcome, the signs of the coefficients on the wealth and line size are reversed, but remain significant at the 1% level.

Given the large number of comparisons and the difficulty in interpreting coefficients in the multinomial logit, I will use graphs showing the ceteris paribus effects of changes in selected independent variables on the predicted probabilities of equilibrium enhancement structure outcomes to convey the finding of this study.

Figure 2.1 summarizes the main results of this study. This graph shows the distribution of the predicted enhancement structure as the log of owner net worth increases. The predicted probabilities for enhancement structures are calculated at the mean of the other variables in the model. As predicted in Essay I there is a systematic relationship between the outside net worth of the borrower's primary owner and the enhancement structure of the firm's line of credit with from its lead bank. As owner net worth increases, holding the size of the line of credit constant at the sample mean of \$268,337, enhancement increasingly takes the form of a personal guarantee, only. Conversely, the prevalence of collateral, either as the sole form of enhancement or in tandem with a guarantee, falls.

These findings contrast to those in Avery et al. (1998) who report "no consistent relationship between personal commitment use and owner wealth." The Avery et al. study predated the inclusion of owner wealth data in the SSBF and relied on the 1989 - 1995 business owner section of the Survey of Consumer Finances (SCF). While the SCF provided data on the wealth of business owners, it did not include data on many other loan characteristics, most importantly, the size of the loan. Essay 1 establishes that it is owner wealth compared to the amount borrowed that will lead to a guarantee only equilibrium enhancement structure for lines of credit.

While the effect of owner net worth is the primary question of interest, results of this estimation find several other variables that have independent effects on the

equilibrium enhancement structure. Further, these results are as expected based on the contracting model in Essay 1.

In Essay 1 and in the discussion of the data generating process in this essay, the existence of a competitive intermediated credit market for small business lines of credit plays an important role in determining the equilibrium form of credit enhancement. Since transactions costs associated with a guarantee are less than those associated with collateral, competitive banks will offer guarantee only credit contracts to borrowers with sufficient wealth to make the repayment value of the guarantee credible. In monopolistic bank markets with moral hazard, Essay 1 argues that the bank can more efficiently extract surplus if it increases enhancement requirements rather than increasing the interest rate charged on the loan.

The effect of competition is captured by a dichotomous variable for the bank deposit share concentrations in the MSA or county where the borrower has its main office. The coefficient on the competitive bank market indicator variable reported in Table 2.4 is positive and statistically significant in the comparisons of all enhancement structures to the base structure, both collateral and a guarantee. This implies that non-competitive markets are associated with a greater proportion of lines of credit enhanced with both collateral and a guarantee and lower proportions that are unenhanced, enhanced with only collateral and enhanced with only a guarantee; at all levels of owner wealth. Figures 2.2a-2.2d graphically display this association.

Figures 2.2a-2.2d show the difference in the effect of owner wealth on the predicted probability for each of the four possible enhancement structures for firms located in concentrated deposit markets compared to non-concentrated markets.⁵¹ The effect of less competition among lenders is an increase in the use of both collateral and a guarantee to enhance a line of credit contract at each level of owner wealth, as shown in Figure 2.2b and a corresponding decrease in the probability the other three enhancement structures at each level of wealth as shown in Figures 2.2a, 2.2c, and 2.2d. This result is consistent with the analysis of contracting in a monopolistic SME credit market in Essay 1.

To further examine the effect of local credit market concentration on enhancement outcomes, two other specifications of the multinomial logit were run. In the first, the estimating sample was bifurcated into competitive and non-competitive subsamples and the full model estimated for each. This specification allows all coefficients to differ between markets. The second specification used all observations in a single model, but added an interaction of the indicator for a competitive market with both outside owner wealth and the amount of the line of credit. Because of the binary nature of the competition indicator variable in the original model, these alternative specifications failed to provide additional insight into the effects of local credit market concentration on enhancement outcomes beyond those reported generated by the main specification.

⁵¹ The level of competition is represented by a binary variable for the combined Herfindahl index for commercial and savings banks. Markets are assumed to be competitive if the Herfindahl index is less than 1800.

The analysis in Essay 1 emphasized that enhancement in the form of a guarantee is more efficient than collateral, provided that the guarantor has sufficient outside net worth relative to the size of the loan. Further, because many of the dissipative costs associated with collateral are fixed costs, the proportionate efficiency gains from guarantee use should be greater for smaller lines of credit than for large ones. The propensity to see guarantees rather than collateral in equilibrium line of credit contracts should thus be greater for small lines of credit than for larger ones. Figures 2.3a – 2.3d show the differential in effect of owner net worth on the predicted probability that each enhancement structure will appear in the equilibrium contract between a \$30,000 line of credit and a \$1,000,000 line of credit. Again, predicted probabilities are calculated at the means for other variables in the model. These results indicate that guarantee use is more prevalent for smaller lines of credit where the fixed costs associated with collateral have a proportionately greater impact on the borrower's total cost of debt capital. This effect occurs at all levels of owner net worth but increases as owner net worth increases.

Earlier in this paper, I argued that owner management tends to confound the firm's profit function with the owner's personal utility function. This confounding increases the risk of moral hazard faced by the firm's creditors. The owner-manager is in a position to have an early warning of adverse business results and has both the incentive and means to divert both business assets and cash flows to personal use. Collateralization with business assets is a particularly useful device to mitigate the risk of asset diversion. An owner guarantee is a similarly useful device to mitigate the risk of cash flow diversion from the business to the owner-manager. We would thus expect to see an increased

propensity for the use of both collateral and a guarantee for owner managed firms.

Figures 2.4a-2.4d provide empirical support for this argument. Figure 2.4b illustrates the increased propensity of the lead line of credit to be enhanced with both collateral and a guarantee when the firm is managed by a major owner.

Post-estimation Specification Testing and a Robustness Test

Diagnostic testing of the MNL model takes several forms. I discuss tests for non correlation of the errors across enhancement structures (Independence of Irrelevant Alternatives), tests for combining enhancement structures, and tests for the irrelevance of independent variables in distinguishing among enhancement structures.

Testing for the Irrelevance of Independent Alternatives (IIA) Assumption

The multinomial logit model assumes that the error terms in the underlying random utility model are not correlated across alternatives or, conversely, that adding or removing an outcome from the choice set should not change the odds ratio between two existing outcomes. In the literature these assumptions are known as the Independence of Irrelevant Alternatives (IIA) and they can be seen in the structure of the MNL model where the odds ratio

$$\frac{\text{Prob}(y=m|x)}{\text{Prob}(y=n|x)} = \exp \{x(B_{m|b} - B_{n|b})\} \quad (2.15)$$

does not depend on alternatives other than m and n.

This condition is most likely to hold when the options in the choice set represent distinct alternatives rather than close substitutes. If this is the case, adding another distinct alternative is less likely to affect the relative frequency with which any two of alternatives are chosen.

In this paper, I show that collateral and owner guarantees are distinct alternatives for the contracting parties when guarantors are wealthy relative to the amount of the line of credit commitment. It is not clear that this distinction applies when owner wealth is relatively low or, more generally, on average across the distribution of guarantor wealth. Since IIA is an assumption of the Multinomial Logit Model, I have used two distinct tests for the validity of this assumption, the Hausman-McFadden (HM) test and the Small-Hsiao (SH) test.

Both the HM and SH tests employ a general strategy of comparing the estimated coefficients of a restricted model to those of the full or unrestricted model. The full model contains all alternative choice outcomes; in this case, the four forms of credit enhancement — no enhancement, collateral only, both collateral and a guarantee, and a guarantee only. The restricted model omits one of these enhancement alternatives. If the coefficient estimates for the two models are not statistically different, then both models will predict similar odds ratios between each pair of choices, and IIA is deemed to hold. If the estimated coefficients of the restricted and unrestricted models are sufficiently different, then omitting an alternative changes the estimated odds ratio between at least one choice and the base alternative and the test reject IIA.

More specifically, the HM test statistic is given by:

$$H = (\hat{B}_R - \hat{B}_F)' \{ \widehat{Var}(\hat{B}_R) - \widehat{Var}(\hat{B}_F) \}^{-1} (\hat{B}_R - \hat{B}_F) \quad (2.16)$$

where \hat{B}_R is the vector of estimated coefficients in the restricted model and \hat{B}_F is the vector of coefficients in the full model using the full sample. H has an asymptotic, chi-squared distribution with degrees of freedom equal to the number of estimated coefficients in both the unrestricted and restricted models. Table 2.6 reports the results of this test: the guarantee only alternative is independent of the other alternatives and the χ^2 statistics for the other three alternatives are negative.

If the test statistic, H , is negative, Stata reports that the asymptotic assumptions of the test are not met.⁵² Hausman and McFadden (1984) note that the test statistic may be negative in finite samples as the result of inverting the often very small difference between the estimated variance-covariance matrixes for \hat{B}_R and \hat{B}_F and should be regarded as evidence for the independences of alternatives. The Hausman test thus provides evidence that the odds between the four enhancement types in the model are not affected by the addition of or deletion of one of the alternative enhancement types in the choice set.

The Small-Hsiao test for validity of the IIA assumption is based on a likelihood ratio test and avoids the computational and inference problems that may arise in the HM test when inverting the difference between the estimated variance-covariance matrixes for

⁵² The asymptotic distribution of H is Chi-squared where the p-lim of the variance covariance matrix for \hat{B} is a vector of the variances of the elements of \hat{B} .

\hat{B}_R and \hat{B}_F . The SM test involves a random bifurcation of the observations into two subsamples. The two samples are then used to obtain two estimates of the coefficient vectors for the unrestricted model, $\hat{B}_u^{S_1}$ and $\hat{B}_u^{S_2}$ from which a weighted average vector, $\hat{B}_u^{S_1 S_2}$ is calculated as $\left[\frac{1}{\sqrt{2}}\right] \hat{B}_u^{S_1} + \left\{1 - \left(\left[\frac{1}{\sqrt{2}}\right]\right)\right\} \hat{B}_u^{S_2}$.

Next, the second subsample, less the observations with the omitted outcome, is used to obtain estimates of the coefficient vector for the restricted model, $\hat{B}_r^{S_2}$ and the likelihoods associated with the unrestricted and restricted models fitted with $\hat{B}_u^{S_1 S_2}$ and $\hat{B}_r^{S_2}$, respectively. The test statistic for the Small-Hsiao test is $SH = -2\{L(\hat{B}_u^{S_1 S_2}) - L(\hat{B}_r^{S_2})\}$, which has a chi-square asymptotic distribution with degrees of freedom equal to the number of elements in $\hat{B}_u^{S_1 S_2}$ plus the number of elements in $\hat{B}_r^{S_2}$.

In small samples, such as in this study, results of the SH test are sensitive to the composition of the two subsamples. The test also loses power as the number of covariates increases. The model estimated here has 21 variables. Table 2.7 reports the results of three successive calls of the SM test using different seeds for the random assignment of observations to the two subsamples. The base enhancement alternative is both collateral and a guarantee. The three calls of the SH test demonstrate the sensitivity of the test results to the composition of the bifurcated sample particularly when the estimating sample is relatively small.

The results of both the HM test can be interpreted as supporting that the model conforms to the assumptions of IIA. The SH tests are ambiguous. Cheng and Long

(2005) used Monte Carlo studies to evaluate both the HM and SH tests and find that both have poor small sample properties and often do not improve as sample size increase. They conclude that the neither test is particularly useful for determining consistency with the IIA property. Based on these tests, I can neither accept nor reject that the model conforms to the IIA assumption.

Testing for Combining Enhancement Categories

An implicit assumption in my empirical model is that the coefficients on the independent variables are useful in explaining the relative likelihood that a particular enhancement structure will emerge in the equilibrium line of credit debt contract. Specifically, if the fitted model does not provide meaningful information regarding the relative odds of any two alternative enhancement structures, these alternatives are said to be indistinguishable. Failure of the independent variables in the model to distinguish between two alternatives, m and n , corresponds to the hypothesis: $H_o: \beta_{m|n} = 0$ where $\beta_{m|n}$ is the vector of coefficients on the non-intercept explanatory variables in the comparison of alternative m to alternative n . Table 2.8 reports the results of likelihood ratio test for combining all pairs of enhancement structures in the model. The test rejects indistinguishably between any two alternatives. The guarantee-only and no enhancement categories are, however, distinguishable at only a 9% significance level.

Testing for Irrelevance of Independent Variables

In the multinomial logit model with J outcomes, $J-1$ coefficients are estimated for each explanatory variable. If an explanatory variable is superfluous, its coefficient in

each of the $J-1$, comparisons is proximately zero. Formally, for a MLM model with four outcomes, one of which is the base outcome, b , we have $H_0: \beta_{i,m|b} = 0$ for $m = 1, 2, 3$ and 4 where i indexes the explanatory variables. Results of a Wald test of this hypothesis for each independent variable are reported in Table 2.9. The following variables have the greatest statistical power in distinguishing among alternative enhancement structures: owner outside net worth, amount of the line of credit, a competitive banking market, financial leverage, a transportation and communications rather than retail industrial classification, and age of the firm.

This test finds several variables that have limited explanatory power in distinguishing among alternative enhancement outcomes. The indicators for being a wholesale or mining rather than a retail business have limited explanatory value but are just two of a vector of industry dummies that likely have joint discriminatory power. The other variable with limited explanatory power is the indicator for the business being family owned. The lack of discriminatory power for this indicator is likely related to the preponderance of family owned businesses in the sample.⁵³ To avoid over-fitting of the model to the data, I have chosen to retain these irrelevant explanatory variables the inclusion of which is based in theory.

Simultaneity and Selection

Since credit contracts are written in the joint space of credit enhancement and interest rates, one might expect that simultaneity of the form of credit enhancement and

⁵³ Table 2.3 shows that 75% of the firms in the estimating sample are family owned.

the interest rate to be a concern for empirical estimates of the effect of owner wealth on the equilibrium enhancement structure. In the moral hazard based models of Essay 1, however, the lender's binding zero profit constraint generates a deterministic relationship between the model parameters and both the equilibrium interest rate and credit enhancement.⁵⁴ While the interest rate reflects the costs of enhancement incurred by the lender, there are no other links between the enhancement structure and the rate charged. Were there data on the contractual interest rate, it would be possible to add it as an independent variable in the model as a test for simultaneity.⁵⁵ Such a test would also need to control for lender costs incurred to obtain credit enhancement since such costs are frequently embedded in the contractual interest rate. The theory developed in Essay 1, however, suggests that this test would not find evidence of simultaneity provided that moral hazard is the dominant form of informational problem in the SME credit market.

The lack of simultaneity between credit enhancement and interest rates can also be illustrated in a manner that is less specific to the model of Essay 1 but, rather, draws from the general literature on moral hazard in credit markets. In an environment of moral hazard, credit contract terms of collateral and interest rates are not substitutes; rather, they have opposite effects on the borrower's ex post incentives to shift expected returns to itself at the expense of the lender. Higher loan interest rates reduce the borrower's returns from a successful "project" and hence increase his incentives to take ex-post

⁵⁴ In Essay 1, the equations for the equilibrium interest rate, i^* , in both the collateral and guarantee models, can be rewritten solely in terms of the model parameters by substituting the full expression for C^* and G^* , respectively, into these two equations. The expressions for C^* and G^* do not contain i^* .

⁵⁵ Berger and Udell (1995) employ this strategy and conclude that simultaneity of contract terms is not a significant problem.

actions such as diverting returns, increasing business risk, and shirking. That is, higher interest rates increase the degree of moral hazard. Increases in the amount of credit enhancement, conversely, increase the borrower's expected loss in the event of a project failure and provide incentives for the borrower to accurately report returns, decrease project risks, and exert additional effort. Consequently, neither the lender nor the borrower is indifferent between credit contracts with differing combinations of interest rates and credit enhancement. In equilibrium, the optimal contract is a unique pair $\{i, \text{enhancement}\}$.

The model that I estimate can be stated as a conditional expectation function:

$$E[Prob(Y_i = j|X_i)] = \frac{e^{X_i'(\beta_j)}}{1 + \sum_{k=1}^K e^{X_i'(\beta_k)}} \quad (2.17)$$

with dummy variables in X set equal to 1 for each of the following conditions: a line of credit was demanded from the lead bank; the lead bank offered a line of credit; and, finally, the line of credit offer was accepted. Formatting the model in this manner highlights that this reduced form model estimates the statistical association between the propensity for a certain enhancement structure, “j”, to appear in the debt contract and the characteristics in X given that the firm demanded a line of credit from its lead bank and received an acceptable contract offer in return. Estimates of this association pertain only to firms that exhibit these three conditions. If, in particular, a significant number of firms declined contract offers for lines of credit from their lead bank and if these firms would have borrowed with systemically different enhancement structures than those accepting the offered contract, then the estimated effects of observables on the propensity

for a certain type of enhancement structure to appear in the line of credit contract are potentially biased.⁵⁶ For example, if firms owned by high wealth but older entrepreneurs tended to decline offers requiring personal endorsements for estate planning reasons, my estimate of the effect of owner wealth on the propensity for guarantees rather than collateral to appear in the equilibrium line of credit contract may be biased upwards. This potential bias can be thought of as endogenous selection bias.

Two conditions are necessary for this selection to bias the estimated effect of owner net worth on the equilibrium form of enhancement. The first is that a significant number of firms in the 2003 SSBF received line of credit offers from their lead bank but declined to accept them. Secondly, the effect of owner wealth on the offered enhancement structure would have to be materially different for the firms declining offers than those accepting them. While the data does not support addressing the second condition, the degree to which the first condition obtains can be addressed.

To assess the potential for selection bias in the estimates of the effect of owner wealth on the propensity for the equilibrium credit enhancement structure to consist of only a guarantee, I have used the most recent loan approval records in the 2003 SSBF. This section of the 2003 SSBF provides data on the ultimate outcome of the firm's most recent credit demand, provided that the credit demand was made in the three years prior to the survey date. The possible outcomes for a credit demand are approved and accepted, subsequently approved and accepted (I interpret this to be cases of ultimately

⁵⁶ Firms not receiving a contract offer are viewed as having been rationed out of the market by price and non-price elements prevailing in the market and do not represent a source of selection bias.

successful, protracted negotiation with a single lender or search across multiple lenders), and an ultimately unmet credit demand. In this latter case of an unmet credit demand, it is not possible to determine if no offer was forthcoming or if the best offer was still unacceptable. This third category does, however place an upper bound on the portion of credit demands that may have led to offers that the borrower declined.

The outcomes for credit demands are summarized in Table 2.10. This data indicates that there is an upper bound of 6.3 percent to 6.2 percent for unaccepted offers for all credit demands by limited liability firms for all loans and for lines of credit from all sources. Since I estimate the effect for lines demanded for the firm's lead bank, the upper bound for non- accepted offers is only 4.7 percent in the estimating sample. This suggests that selection bias in my empirical model is limited.

Robustness Testing Using an Ordered Probit Specification

Though I have argued that the multinomial logit specification better reflects the non-ordered relationship among the alternative enhancement structures, an ordered probit specification was run as a robustness test. For the ordered probit model, the alternative enhancement structures were ordered as follows: 1) collateral only, 2) both collateral and a guarantee, 3) guarantee only, and 4) no enhancement. This ordering represents an underlying index of declining dissipative cost of credit enhancement. I used the same estimating sample as that used in the multinomial logit specification. The coefficients on both owner outside net worth and the line of credit commitment amount, as reported in Table 2.11, are significant at the 1 % level. Their signs indicate that increases in owner

outside net worth compared to the amount of the line of credit increase the likelihood that the form of enhancement is a guarantee only rather than collateral only or both collateral and a guarantee. This result is consistent with that obtained from the multinomial logit specification and provides further support for the major results of this study.

The coefficient on the competitive banking market indication is also positive and is significant at the 10% level. This implies that banks in non-competitive markets are more likely to require line of credit enhancement structures of collateral and both collateral and a guarantee than will banks in competitive markets. This result is also consistent with both the predictions of Essay 1 and the results of the multinomial logit model.

In contrast to the multinomial logit model, the estimated coefficients in the ordered probit are constrained to be constant across alternatives. That is, the model implies that the coefficient vectors β_m for the $J-1$ binary regressions: $pr(y \leq m|x) = F(\tau_m - x\beta_m)$ for $m = 1, J-1$ are all equal. This is a consequence of the ordering in the categories of the polychotomous dependent variable and the assumption of a continuous index underlying these ordinal categories. The model is, in essence, estimating the constant effect of changes in the independent variables on the underlying index. The equality of the coefficients can be tested by estimating these $J-1$ binary models and comparing them to the constant vector, β , for the full ordered model. To test the parallel regression assumption, a likelihood-ratio test was used to test for equality of coefficients across alternatives. This test compares the coefficient estimates for a nested model with

those estimated for the full choice model. If the parallel regression assumption is valid, the estimated coefficients are the same. The likelihood ratio test rejected the equality of coefficients across alternatives at less than a 1% significance level. It is important to note, however, that the LM test requires that all coefficients are equal in all binary comparisons. Consequently it is a very severe test of the parallel regression assumption and is often violated.⁵⁷

In summary, the results of the ordered model confirm and strengthen those found in the multinomial model. The partial effect of increasing owner wealth is to increase the probability that a line of credit will be enhanced with only a guarantee and to decrease the probability that the enhancement structure will include collateral. The ordered probit model also predicts that this effect will be lower in non-competitive markets than in competitive bank markets.

Summary

This essay highlights the role of owner wealth in determining the equilibrium credit enhancement structure for lines of credit. While the role and determinants of collateral have long fascinated economists and spawned a deep and rich literature, there has been remarkably little study of the reasons for and determinants of the observed heterogeneity in the types or structures of credit enhancement. Surprisingly little attention has been paid to the pervasive and growing use of owner guarantees as an alternative or complementary form of credit enhancement to collateral. This essay finds

⁵⁷ Long and Freese (2006)

evidence that owner wealth an important determinant of tradeoffs between the use of guarantees, collateral and both guarantees and collateral to enhance lines of credit of small businesses operating with limited liability.

This empirical study of the effect of owner wealth on SME credit market outcomes was motivated by the theoretical predictions of Essay 1. Essay1 predicts that a guarantee-only enhancement structure will emerge in the equilibrium credit contract if the owner is sufficiently wealthy compared to the amount borrowed. Using the 2003 SSBF, which includes information on the outside net worth of the primary business owner, on the size of the line of credit provided by the SME's primary bank and on the form of credit enhancement, I am able to empirically test this prediction. Using a sample of 1224 limited liability firms having a line of credit with their primary or lead bank, I first estimated a multinomial logit model for four alternative credit enhancement structures — no enhancement, collateral only, both collateral and a guarantee, and a guarantee only.

The results of this estimation are entirely consistent with the predictions of Essay 1 - for a given sized line of credit commitment, increases in owner wealth are associated with an increase in the prevalence of a guarantee only enhancement structure and corresponding decrease in the prevalence of collateral only and collateral and guarantee enhancement structures. The empirical results also show the converse of this: for each level of owner wealth, a decrease in the size of the line of credit is also associated with an increase in the prevalence of a guarantee-only enhancement structure and corresponding

decrease in the prevalence of collateral-only and collateral and guarantee enhancement structures. To test the robustness of these results to alternative model specifications, an ordered probit model was estimated. In this model, the ordering of the alternative enhancement structures was motivated by the relative dissipative cost associated with their use as discussed in Essay 1. The results of the ordered specification were the same as those in the unordered model: increases in owner wealth are associated with an increase in the prevalence of enhancement in the form of a guarantee and a decrease in the prevalence of enhancement structures with collateral. The same result is also obtained when the amount of the line of credit decreases.

For credit markets to function efficiently, scarce savings must be allocated to investment projects with the highest expected returns. The results of this essay suggest that the effect of owner wealth on the equilibrium enhancement structure in line of credit contracts may be a source of market failure in the SME credit market. Firms with wealthy ownership can obtain a line of credit and use ownership wealth to credibly enhance their line of credit. Otherwise similar firms with wealth constrained ownership will be required to provide collateral to enhance their line of credit. Since the dissipative costs associated with guarantees are generally less than those associated with collateral, firms with wealthy ownership can obtain external capital at a lower effective cost and be able to profitably undertake investment projects with lower expected returns than will firms with wealth constrained ownership.

A second important result of this essay was that the degree of banking market competition is systematically associated with the differences in the relative use of guarantees and collateral to enhance lines of credit. Specifically, this essay found that non-competitive banking markets are associated with a greater propensity to enhance lines of credit with collateral rather than guarantees. This empirical association was found at high levels of statistical significance in both the multinomial logit and ordered probit specifications and was consistent with the prediction of Essay 1. Given the higher dissipative costs associated with collateral use, this result points to another source of efficiency loss from market concentration and suggests another rationale for regulatory efforts to maintain competitive conditions in the intermediated credit markets on which small businesses depend for external debt capital.

The important implication of the main result of this essay — that an owner's wealth is an important element in determining whether a project will secure funding in the small business credit market — represents a potentially important impediment to the key efficiency condition that capital should be allocated based only on expected project returns. The prospect of this market failure, moreover, suggests that appropriate policy interventions could improve the efficiency of the private small business loan market. One such intervention is the provision of public guarantees for loans to projects with high expected returns that are proposed by entrepreneurs with low levels of wealth. Such guarantees are already available in the U.S. through programs in the Small Business Administration of the Department of Commerce.

Tables

Table 2.1. Aggregate Capital Structure of SMEs in the 2003 SSBF

Source	\$(mmm)	%
Line of credit borrowing	403	14.5%
Commercial Mortgages	305	11.0%
Vehicle Loans	40.1	1.4%
Equipment Loans	61.5	2.2%
Capital Leases	13.2	0.5%
Other Loans	82.5	3.0%
Total Funded Debt:	905.3	32.5%
Trade Credit	380	13.6%
Owner Loans	0	0.0%
Total Debt	1285.3	46.1%
Equity	1500	53.9%
Total Capital	2785.3	100.0%
Sources:		
Unused lines of credit	485	17.4%

Notes: The reported totals are point estimates using all 4240 observations in the 2003 SSBF, each weighted by the inverse of its sampling probability. Line of credit borrowing includes only outstandings under line of credit commitments. The unused portion of committed lines is shown in the last row of the table.

Table 2.2. Estimated Prevalence of Lead Line Enhancement Structures - All Limited Liability Firms

Enhancement Structure	Proportion	Std. Err.	95% Confidence Interval	
No Enhancement	0.210	0.019	0.173	0.246
Collateral only	0.119	0.014	0.091	0.147
Collateral & Guarantee	0.303	0.020	0.264	0.343
Guaranty only	0.368	0.021	0.326	0.410

Notes: The second column reports the estimated proportions of enhancement structures on lines of credit with lead banks for the subpopulation of MSEs that are organized with limited liability. The estimates are based on a weighted sample of 1326 observations from the 2003 Survey of Small Business Finances.

Table 2.3. Sample Means of Independent Variables for Estimations

Variable	Whole Sample			Not Enhanced		Collateral Only		Collateral & Guarantee		Guarantee Only	
	n	Mean	Std. Dev.	n	Mean	n	Mean	n	Mean	n	Mean
Construction & Mining	1228	0.139	0.346	198	0.136	182	0.121	454	0.141	394	0.147
Manufacturing	1228	0.199	0.399	198	0.157	182	0.308	454	0.236	394	0.127
Transport & Communications	1228	0.055	0.229	198	0.020	182	0.071	454	0.064	394	0.056
Wholesale	1228	0.116	0.320	198	0.121	182	0.126	454	0.128	394	0.094
Retail	1228	0.162	0.369	198	0.202	182	0.126	454	0.152	394	0.170
Insurance & Real Estate	1228	0.040	0.196	198	0.045	182	0.005	454	0.031	394	0.061
Professional Services	1228	0.140	0.347	198	0.146	182	0.115	454	0.106	394	0.188
Other Services	1228	0.150	0.357	198	0.172	182	0.126	454	0.143	394	0.157
Age of Firm (log years)	1228	2.659	0.812	198	2.637	182	2.864	454	2.638	394	2.601
Total Assets (log)	1225	13.868	1.982	198	13.516	180	14.641	454	14.271	393	13.233
Return on Sales	1227	0.025	1.555	198	0.108	182	0.101	453	-0.072	394	0.060
Leverage	1225	0.618	1.563	198	0.424	180	0.636	454	0.737	393	0.566
# of Owners (log)	1228	0.831	0.857	198	0.766	182	1.131	454	0.867	394	0.685
Owner Wealth (log)	1228	13.930	1.331	198	13.776	182	14.138	454	13.965	394	13.869
Owner Managed	1228	0.860	0.347	198	0.859	182	0.802	454	0.877	394	0.868
Family Owned	1228	0.750	0.433	198	0.778	182	0.709	454	0.736	394	0.772
Specialty Lender	1228	0.033	0.178	198	0.010	182	0.033	454	0.048	394	0.025
Competitive Deposit Market	1228	0.742	0.438	198	0.778	182	0.769	454	0.696	394	0.764
Relationship Duration	1228	11.429	10.676	198	12.608	182	11.442	454	10.748	394	11.637
Has Other Line Lenders	1228	0.144	0.351	198	0.197	182	0.104	454	0.132	394	0.147
Size of Line Commitment (log)	1227	12.521	1.799	198	11.815	182	13.353	454	13.109	394	11.813

Notes: Unweighted sample averages for observations used in estimation of both the multinomial logit and the ordered probit models.

Means and the number of non-missing observations are shown for the entire estimating sample and for each of the four enhancement structures.

Table 2.4. Estimated Coefficients for Multinomial Logit Model

Variable	No Enhancement			Collateral Only			Guarantee Only		
	Coef.	Std. Err.	P>z	Coef.	Std. Err.	P>z	Coef.	Std. Err.	P>z
Construction & Mining	-0.109	0.324	0.74	-0.052	0.354	0.88	0.144	0.270	0.59
Manufacturing	-0.308	0.309	0.32	0.368	0.305	0.23	-0.360	0.264	0.17
Transport & Communications	-1.465	0.588	0.01	0.269	0.426	0.53	-0.219	0.355	0.54
Wholesale	0.045	0.338	0.89	0.067	0.358	0.85	-0.042	0.293	0.89
Insurance & Real Estate	-0.081	0.514	0.88	-1.817	1.091	0.11	0.275	0.417	0.51
Professional Services	0.087	0.338	0.80	0.264	0.377	0.48	0.408	0.282	0.15
Other Services	-0.235	0.314	0.46	0.071	0.356	0.84	-0.247	0.270	0.36
Age of Firm (log years)	0.023	0.123	0.85	0.314**	0.129	0.02	0.001	0.100	0.99
Total Assets (log)	0.142	0.089	0.11	-0.012	0.098	0.91	-0.016	0.073	0.83
Return on Sales	0.194	0.259	0.45	0.709*	0.384	0.07	0.079	0.078	0.31
Leverage	-0.287***	0.138	0.04	0.013	0.056	0.82	-0.129	0.060	0.03
# of Owners (log)	0.158	0.137	0.25	0.213*	0.112	0.06	0.019	0.117	0.87
Owner Wealth (log)	0.181**	0.086	0.04	0.027	0.084	0.75	0.327***	0.071	0.00
Owner Managed	-0.429	0.276	0.12	-0.385	0.247	0.12	-0.364	0.231	0.12
Family Owned	0.021	0.247	0.93	0.002	0.234	0.99	-0.021	0.205	0.92
Specialty Lender	-0.931	0.778	0.23	-0.570	0.492	0.25	0.259	0.434	0.55
Competitive Bank Market	0.602***	0.214	0.01	0.476**	0.212	0.03	0.408**	0.171	0.02
Relationship Duration	0.013	0.009	0.14	0.004	0.009	0.64	0.009	0.008	0.24
Has Other Line Lenders	0.442*	0.252	0.08	-0.120	0.292	0.68	0.029	0.223	0.90
Size of Line Commitment (log)	-0.732***	0.097	1.00	0.009	0.099	0.93	-0.628***	0.081	0.00
Constant	3.604	1.163	0.00	-2.556	1.184	0.03	3.350	0.958	0.00

Notes: The base outcome is both the collateral and guarantee enhancement categories. Sampling weights were used to estimate coefficients. The estimating sample consists of 1224 firms organized with limited liability that have a non-governmental institutional lead line provider. The omitted industry is Retail.

***Significant at the 1% level

**Significant at the 5% level

*Significant at the 10% level

Table 2.5. Marginal Effects at the Means of the Independent Variables

Variable	No Enhancement		Collateral Only		Collateral & Guaranty		Guarantee Only		Mean Value of X
	dy/dx	P>z	dy/dx	P>z	dy/dx	P>z	dy/dx	P>z	
Construction & Mining	-0.020	0.57	-0.010	0.78	-0.010	0.85	0.040	0.46	0.14
Manufacturing	-0.030	0.35	0.070*	0.09	0.039	0.46	-0.079**	0.09	0.20
Transport & Communications	-0.119***	0.00	0.068	0.27	0.068	0.37	-0.018	0.80	0.06
Wholesale	0.007	0.87	0.009	0.83	-0.001	0.81	-0.014	0.80	0.12
Insurance & Real Estate	-0.008	0.89	-0.116***	0.00	0.011	0.91	0.113	0.20	0.04
Professional Services	-0.015	0.66	0.010	0.82	-0.070	0.21	0.076	0.18	0.14
Other Services	-0.020	0.55	0.024	0.57	0.041	0.47	-0.045	0.35	0.15
Age of Firm (log years)	-0.003	0.81	0.035***	0.01	-0.018	0.39	-0.014	0.47	2.66
Total Assets (log)	0.019**	0.05	-0.004	0.74	-0.006	0.70	-0.010	0.47	13.87
Return on Sales	0.007	0.83	0.073*	0.08	-0.058**	0.05	-0.022	0.38	0.03
Leverage	-0.031*	0.07	0.013*	0.06	0.033***	0.01	-0.015	0.27	0.62
# of Owners (log)	0.015	0.35	0.020*	0.09	-0.023	0.31	-0.013	0.58	0.83
Owner Wealth (log)	0.007	0.50	-0.015*	0.10	-0.054***	0.00	0.062***	0.00	13.94
Owner Managed	-0.030	0.39	-0.019	0.50	0.088**	0.04	-0.040	0.38	0.86
Family Owned	0.004	0.90	0.001	0.98	0.001	0.97	-0.006	0.88	0.75
Specialty Lender	-0.091*	0.05	-0.053	0.14	0.024	0.80	0.120	0.23	0.03
Competitive Bank Market	0.046**	0.04	0.025	0.23	-0.114***	0.00	0.042	0.19	0.74
Relationship Duration	0.001	0.24	0.000	0.86	-0.002	0.17	0.001	0.43	11.46
Has Other Line Lenders	0.065*	0.06	-0.023	0.40	-0.027	0.54	-0.014	0.74	0.14
Size of Line Commitment (log)	-0.064***	0.00	0.042	0.00	0.123***	0.00	-0.102***	0.00	12.52

Notes: dy/dx gives the marginal effect of a one unit change in each independent variable on the probability that the respective enhancement structure will appear in the equilibrium debt contract. dy/dx is for a discrete change in a dummy variable from 0 to 1. These marginal effects are calculated at the mean value of all independent variables. The mean values are shown in the far right column.

***Significant at the 1% level

**Significant at the 5% level

*Significant at the 10% level

Table 2.6. Hausman Tests of IIA Assumption (N = 1224)

Omitted Choice	chi2	df	P>chi2	Evidence
No enhancement	-21.52	42	---	---
Collateral only	-17.91	42	---	---
Guaranty only	1.57	42	1	for Ho
Collateral & Guarantee	-36.16	42	---	---

Notes:

Ho: Odds (Outcome-J vs Outcome-K) are independent of other alternatives. If $\chi^2 < 0$, the estimated model does not meet the asymptotic assumptions of the test.

Table 2.7. Small-Hsiao Tests of IIA Assumption

Omitted Choice:	lnL(full)	lnL(omit)	chi2	df	P>chi2	Evidence
No Enhancement	-598.1	-479.6	237.1	42	0	against Ho
Collateral only	-603.8	-479.4	248.9	42	0	against Ho
Guaranty only	-415.4	-392.4	46.1	42	0.39	for Ho
No Enhancement	-574.7	-477.8	193.8	42	0	against Ho
Collateral only	-530.7	-501.4	58.7	42	0.07	for Ho
Guaranty only	-463.6	-364.3	198.6	42	0	against Ho
No Enhancement	-590.6	-466.9	247.4	42	0	against Ho
Collateral only	-565.1	-493.1	144.1	42	0	against Ho
Guaranty only	-496.4	-377.0	238.8	42	0	against Ho

Notes:

Ho: Odds (Outcome-J vs Outcome-K) are independent of other alternatives. This test is particularly sensitive to the random assignment of observations into two comparison groups when using small samples. I have repeated the test three times to show the non-stability of test results in my 1224 observation sample.

Table 2.8. LR Test for Combining Alternatives

Alternatives Tested	chi2	df	P>chi2
No Enhancement – Collateral only	120.5	20	0
No Enhancement – Guaranty only	26.8	20	0.09
No Enhancement – Both Collateral & Guarantee	140.2	20	0
Collateral only - Guaranty only	154.5	20	0
Collateral only – Both Collateral & Guaranty	39.5	20	0.01
Guaranty only - Both Collateral & Guaranty	182.1	20	0

Notes: (Ho: all Coefficients = 0). This tests for the inability of the independent variables to distinguish outcome m from outcome j.

Table 2.9. Wald Test for Irrelevant Independent Variables

Variable	chi2	df	P>chi2
Firm Age (log)	6.47	3	0.09
Mining & Construction	0.76	3	0.86
Manufacturing	5.49	3	0.14
Transport & Communication	7.62	3	0.05
Wholesale	0.11	3	0.99
Finance, Insurance, & RE	3.98	3	0.26
Professional Services	2.47	3	0.48
Other Services	1.32	3	0.73
Asset Size (log)	3.93	3	0.27
# of Owners (log)	4.54	3	0.21
Owner Net Worth (log)	22.83	3	0.00
Owner Managed	4.17	3	0.24
Family Owned	0.03	3	1.00
Specialty Lender	3.80	3	0.28
Competitive Bank Market	11.62	3	0.01
Lead Relationship Length (yrs)	2.51	3	0.47
Other Line Lender(s)	4.41	3	0.22
Return on Sales	4.34	3	0.23
Financial Leverage	8.18	3	0.04
Lead Line Amount (log)	91.46	3	0.00

Note: Ho: Coefficient = 0 in each comparison.

Table 2.10. Relative Frequency of Credit Approval: Limited Liability Firms in Sample

	All Credit Demands		Line of Credit Demands		Lead Line Demands	
	Number	%	Number	%	Number	%
Approved	1383	90.70%	914	91.00%	764	93.50%
Subsequently Approved	47	3.10%	29	2.90%	15	1.80%
Denied	96	6.30%	62	6.20%	38	4.70%
Totals	1576	100%	1005	100%	817	100%

Notes: Most recent loan records in 2003 SSBF. Unweighted sample counts and percentages.

Table 2.11. Results of Ordered Probit Regression

Variable	Coefficient	Std. Err.
Construction & Mining	-0.006	0.114
Manufacturing	-0.247**	0.106
Transport & Communications	-0.41***	0.153
Wholesale	-0.023	0.12
Insurance & Real Estate	0.159	0.177
Professional Services	0.017	0.117
Other Services	-0.111	0.112
Age of Firm (log years)	-0.071	0.042
Total Assets (log)	0.049*	0.03
Return on Sales	0.015	0.02
Leverage	-0.052**	0.022
# of Owners (log)	-0.041	0.045
Owner Wealth (log)	0.087***	0.029
Owner Managed	-0.053	0.092
Family Owned	-0.019	0.083
Specialty Lender	0.078	0.178
Competitive Deposit Market	0.086	0.071
Relationship Duration	0.005	0.003
Has Other Line Lenders	0.154*	0.091
Size of Line Commitment (log)	-0.290***	0.032

n = 1224

Notes:

The order of alternatives is: collateral only, both, guarantee only, and none.

The excluded industry group is Retail.

Sampling weights were used to estimate coefficients.

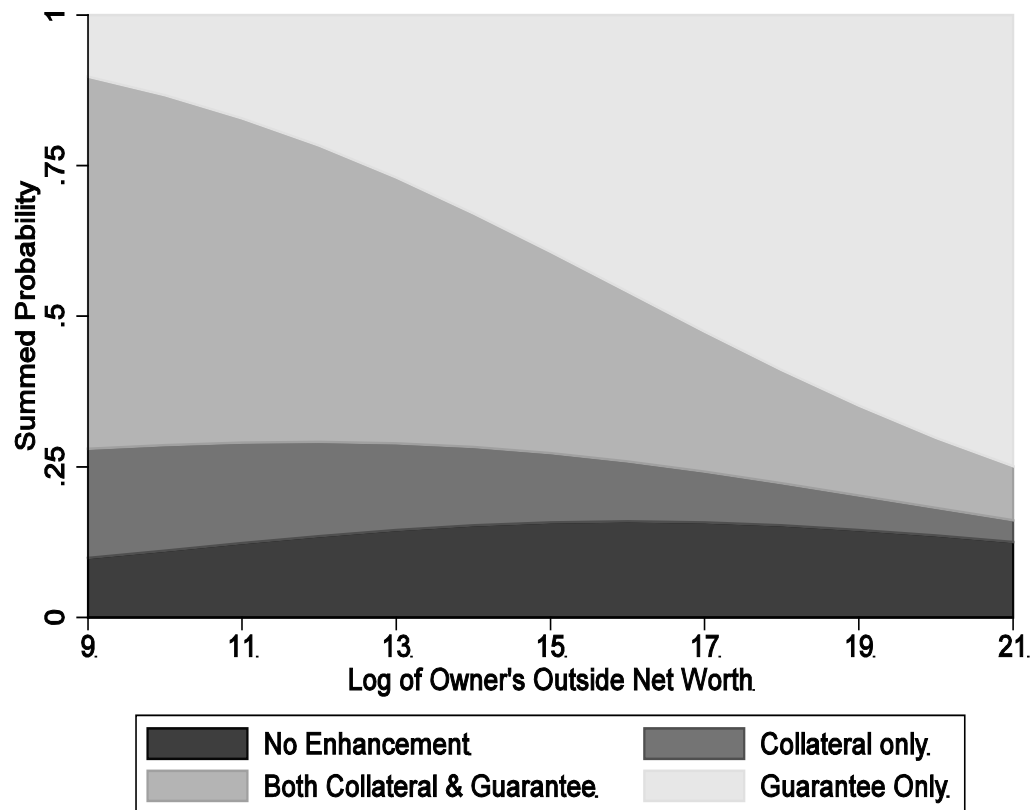
*** Significant at the 1% level.

** Significant at the 5% level.

* Significant at the 10% level.

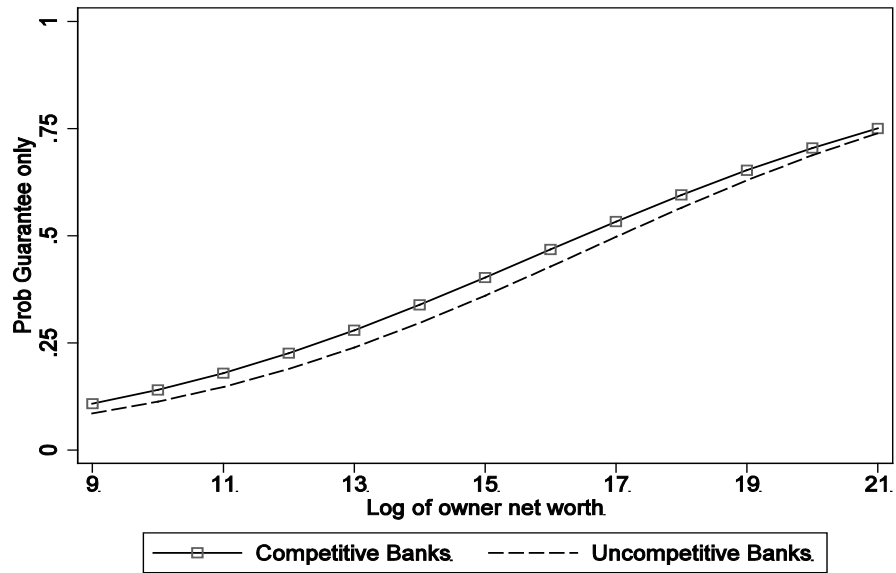
Figures

Figure 2.1. The partial effect of increasing owner wealth on the distribution of credit enhancement structures for the lines of credit of limited liability firms.



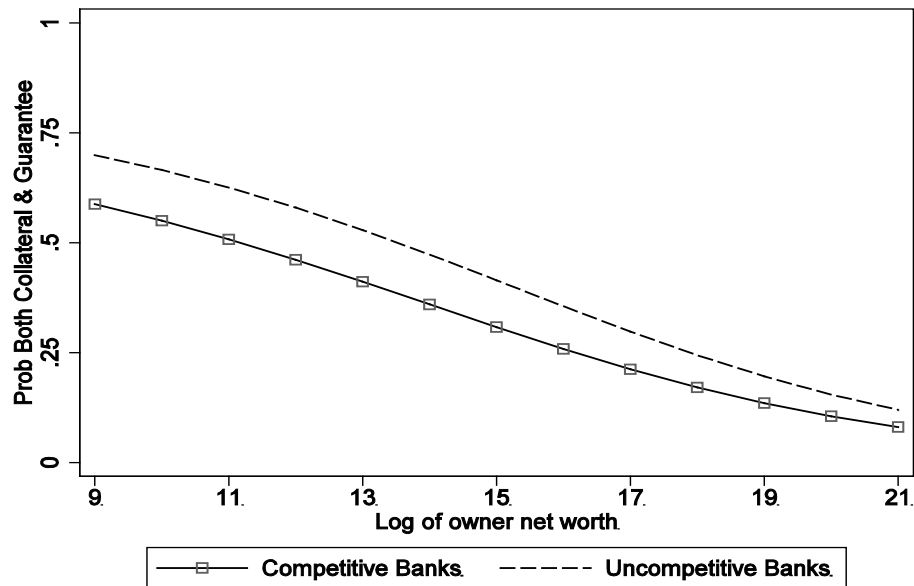
Source: See text.

Figure 2.2a. The effect of banking market competition on the probability that a line of credit will be enhanced with only a guarantee.



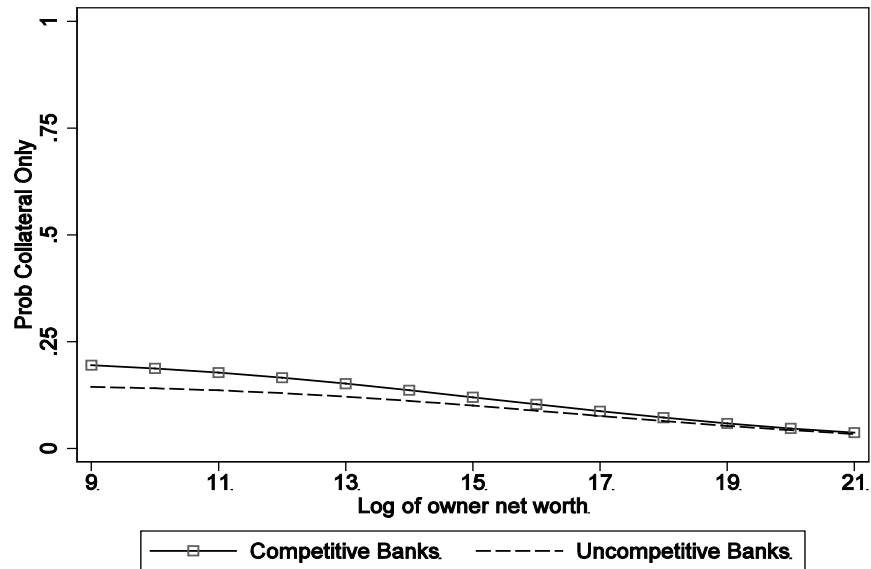
Source: See text.

Figure 2.2b. The effect of banking market competition on the probability that a line of credit will be enhanced with both collateral and a guarantee.



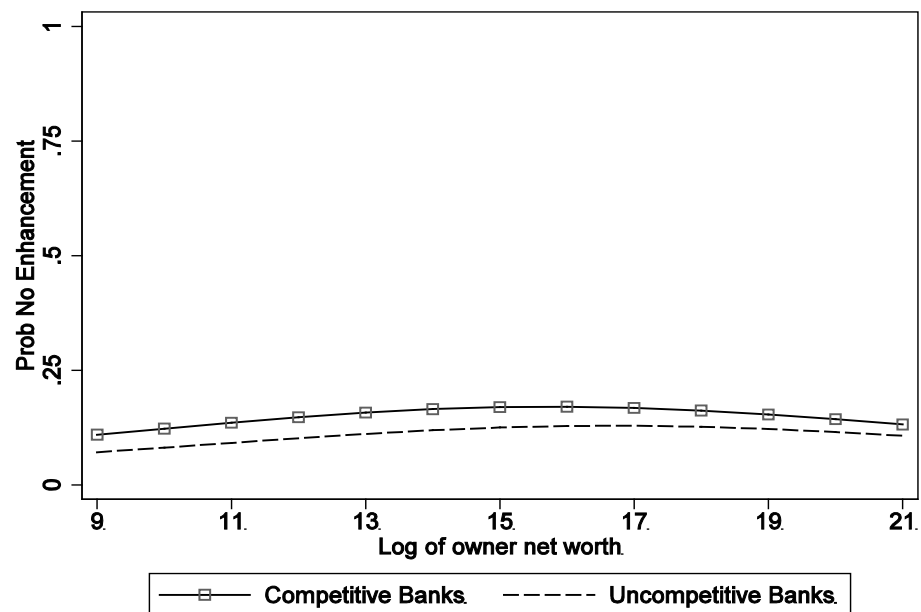
Source: See text.

Figure 2.2c. The effect of banking market competition on the probability that a line of credit will be enhanced with collateral only.



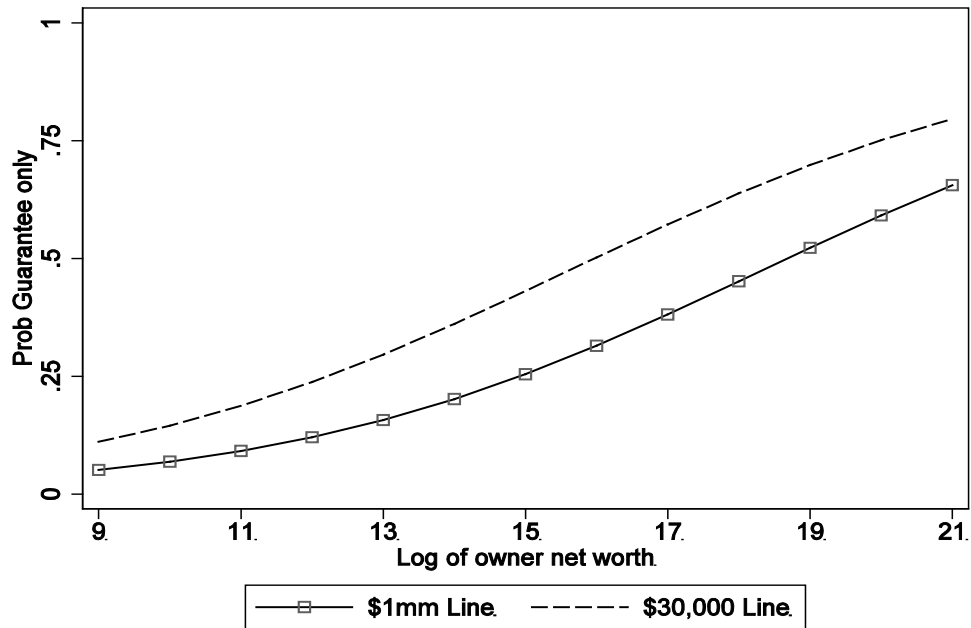
Source: See text.

Figure 2.2d. The effect of banking market competition on the probability that a line of credit will not be enhanced.



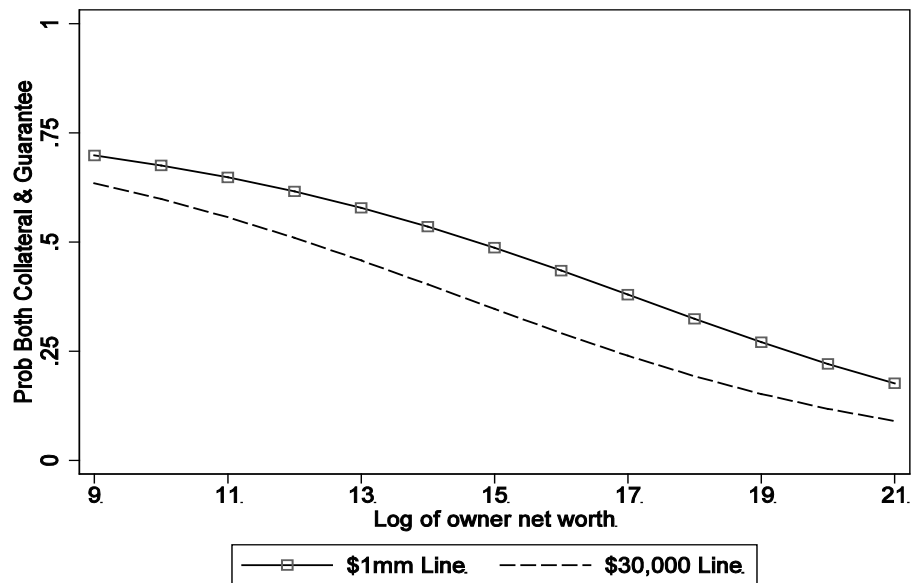
Source: See text.

Figure 2.3a. The effect of the amount of line of credit on the probability that a line of credit will be enhanced with a guarantee only.



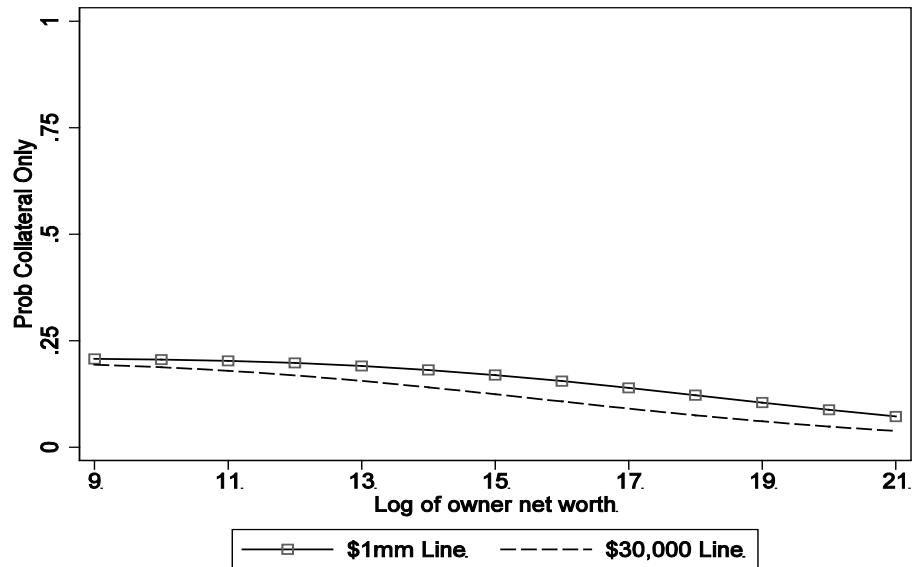
Source: See text.

Figure 2.3b. The effect of the amount of line of credit on the probability that a line credit will be enhanced with both collateral and a guarantee.



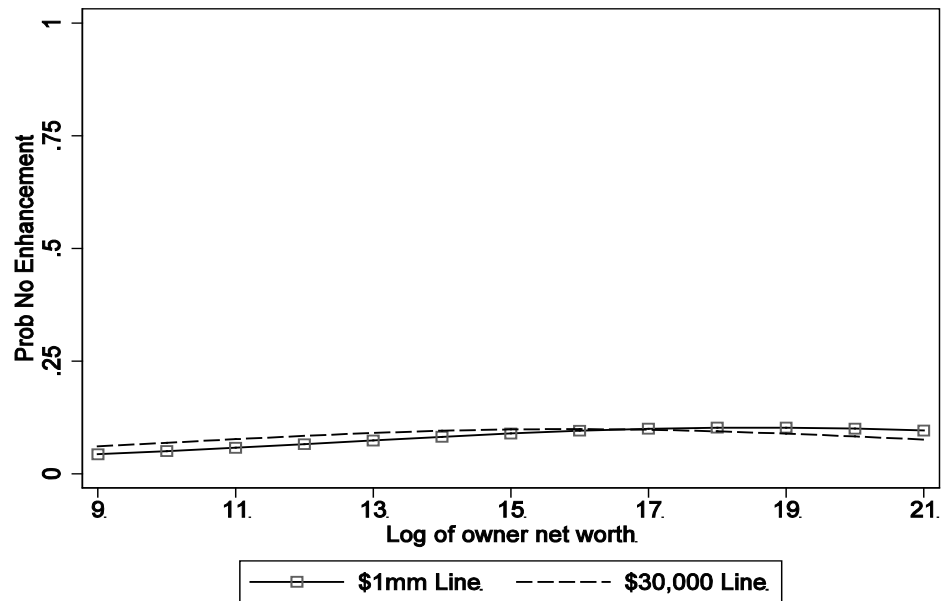
Source: See text.

Figure 2.3c. The effect of the amount of line of credit on the probability that a line of credit will be enhanced with only collateral.



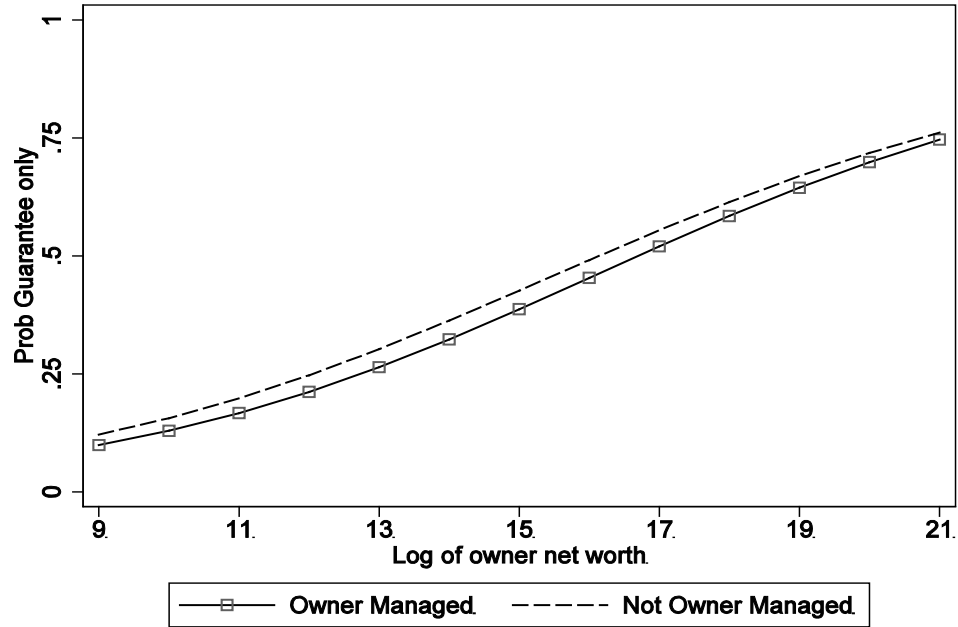
Source: See text.

Figure 2.3d. The effect of the amount of line of credit on the probability that a line of credit will not be enhanced.



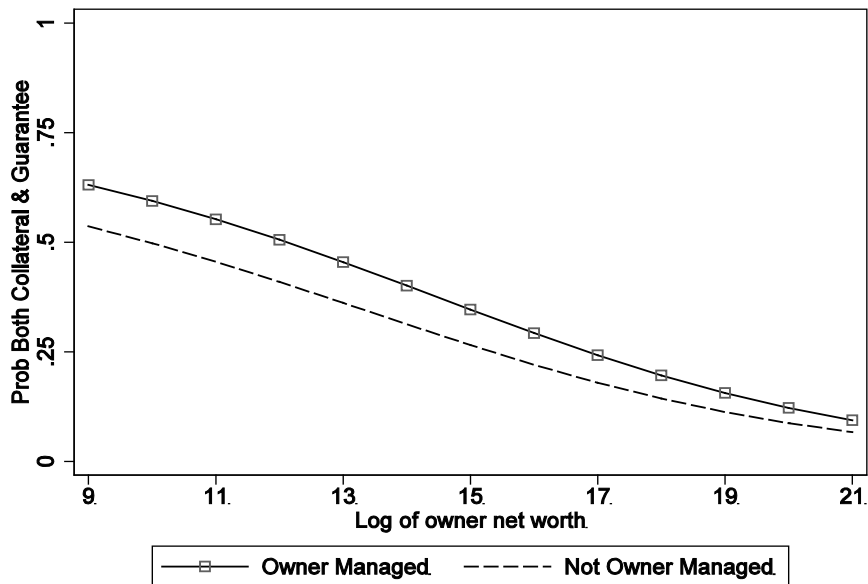
Source: See text.

Figure 2.4a. The effect of owner management on the probability that a line of credit will be enhanced with collateral only.



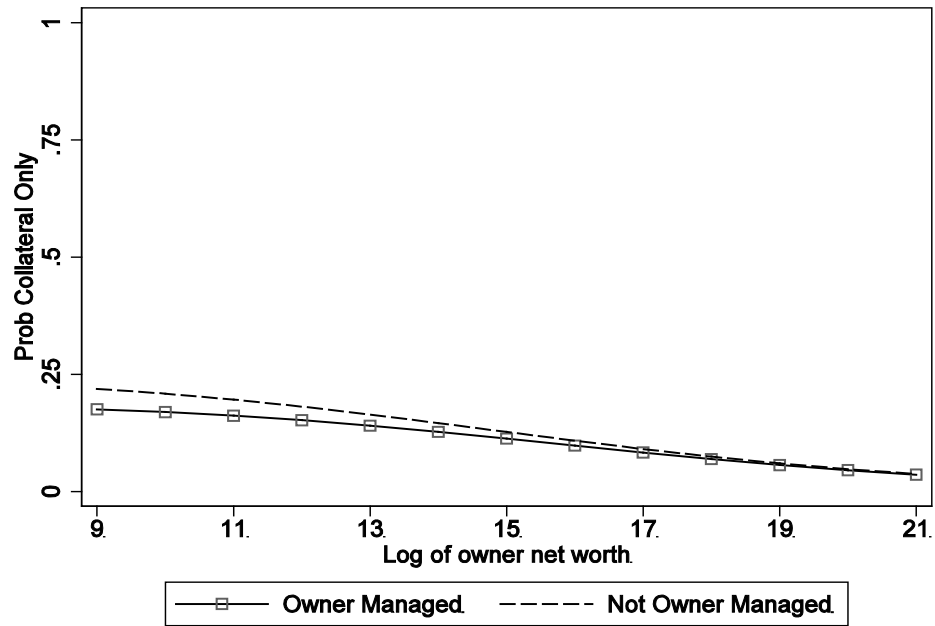
Source: See text.

Figure 2.4b. The effect of owner management on the probability that a line of credit will be enhanced with both collateral and a guarantee.



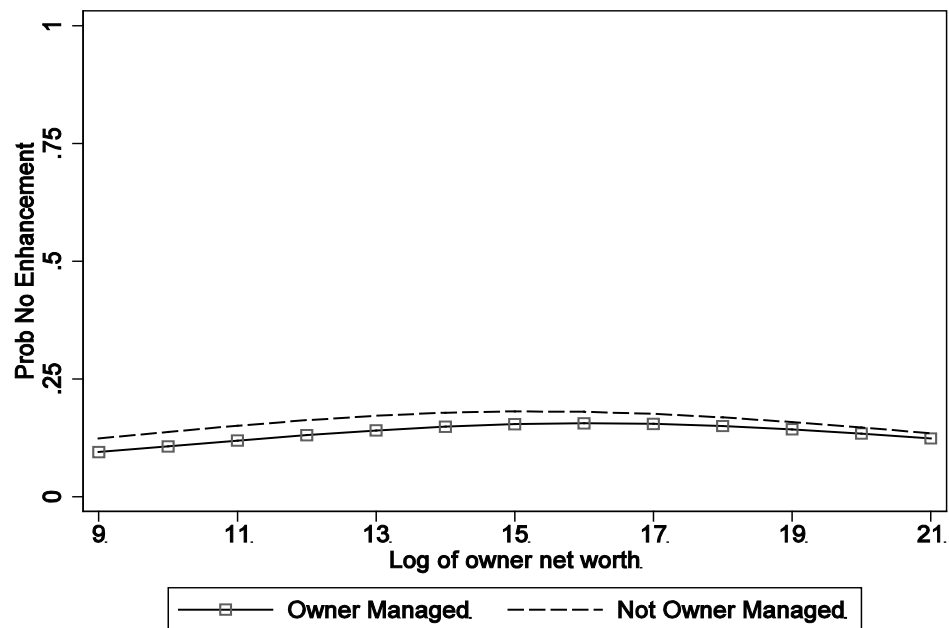
Source: See text.

Figure 2.4c. The effect of owner management on the probability that a line of credit will be enhanced with collateral only.



Source: See text.

Figure 2.4d. The effect of owner management on the probability that a line of credit will not be enhanced.



Source: See text.

CHAPTER III

ESSAY 3 - SMALL BUSINESS-LEAD BANK RELATIONSHIPS: WHAT MIGHT THEY TELL US?

Abstract

Relationships between small businesses and financial intermediaries occupy a prominent place in the finance literature, but are generally viewed only as mechanisms that arise to mitigate informational asymmetries in credit markets. In this essay I argue that the literature could benefit by recognizing that these relationships normally involve financial services other than credit and can be best understood as responses to a wide range of transactions costs which influence the costs and benefits of providing and consuming financial products of all kinds. To support this argument, I develop a new empirical definition of the relationship between a small business and its lead bank and construct two measures of the strength of these relationships: duration and exclusivity. I use this framework to extend the empirical relationship literature in three ways. First, I document that the scope of small business relationships with their self-identified lead provider of financial services varies across different types of firms and over time. Secondly, I present evidence which indicates mechanisms other than mitigation of informational asymmetries influence the structure and benefits associated with maintaining relationships. Finally, I show the two empirical measures of relationship strength decreased between 1988 and 2003 just as the small business credit market was

being transformed by bank consolidation, financial deregulation and technological innovation in small business lending.

Introduction

If small businesses obtained financial services in markets that had neither transactions costs nor informational imperfections, we would observe random bank-firm pairings both across time and across the range of payment, credit and investment services for which they contract. In such a world of perfect markets, relationships between small businesses and their provider(s) of financial services would not exist. The markets in which small businesses seek external debt capital and non-credit financial services are, however, far from perfect. Informational asymmetries and transactions costs abound in this market. These frictions result in pairings of small businesses and their provider(s) of financial services which endure over time and span a range of services. These pairings are referred to as relationships. In this essay, I use the extensive data from the Federal Reserve's Survey of Small Business Finances on small businesses' use of payment, credit and investment services to undertake a systematic, descriptive study of the relationships between small businesses and their primary source of financial services.

The relationships between small and medium enterprises (SME) and banks have been investigated extensively within the existing literature, but primarily as mechanisms to mitigate informational asymmetries that arise in credit transactions. I argue in this essay that this literature could benefit by recognizing that SME-bank relationships are shaped not only by the benefits they may yield in credit transactions, but also by the wide range of transactions costs that arise in relationships that span a range of services and

endure over time. In doing so I do not attempt to provide a “better” definition of SME-bank relationships or to derive a theoretical structure which explains why relationships arise in multi-product markets. Rather, my objective is to take a first step towards developing a systematic empirical framework within which multi-product SME-bank relationships can be categorized and examined, and to use this framework to take a new look at the relationships between small businesses and their primary or “lead” bank.

Towards this end, this essay makes three contributions. First I develop a comprehensive categorization of the combination of services that SMEs contract for with all their financial service providers. Second, I examine the subset of services that each SME receives from its self-designated primary provider of financial services and measure the duration and exclusivity of these SME-lead bank relationships. The evidence shows that the product mix of these relationships varies across industries and that their duration and exclusivity have decreased over time. Third, I use regression analysis to examine the determinants of variations across firms and over time in the duration of these SME-lead bank relationships.

This analysis reveals two important patterns. First, the data reveal that the relationship duration decreased between 1988 and 2003 even after a broad range of firm and market-level correlates have been controlled for. The result is striking because the decrease in duration found here occurred just as consolidation and innovation in small-business lending technology transformed the financial service industry in a way that could have made small business bank relationships less valuable. Secondly, the

regression analysis indicates that duration is linked to a broad range of transactions costs which affect all financial services and not only those that arise because of informational asymmetries in the credit market. This evidence challenges the conventional view in the literature that SME-bank relationships provide benefits only in the credit market and that these benefits are best measured by relationship duration.

The essay begins with a brief review of the literature on SME-bank relationships that demonstrates how the reliance of previous work on informational asymmetries has led the literature to focus only on relationships in the credit market. *Data on Small Business Financial Relationships* discusses the Survey of Small Business Finances and the data from it that will be used here to examine the multi-product scope of the SME-lead bank relationship. *The Use of Financial Products by Small Businesses* discusses the types of financial services contained in the 1988 – 2003 SSBFs and how they may be combined into three broad categories: payment services, credit, and investments. *Defining and Measuring SME Relationships with Their Lead Bank* begins the analysis of the types of services that SMEs obtain from their self-identified lead bank. This discussion sets up the empirical investigation of relationship duration in *The Empirical Correlates of Durations of Lead Bank Relationships, 1988-2003*. Finally, *Summary and Conclusions* summarizes and discusses the main results of the essay.

The Emphasis on Credit in the Literature on SME-Bank Relationships

The study of relationships between businesses and financial intermediaries occupies a prominent position in the finance literature. This literature has, however,

studied relationships almost exclusively in the context of mechanisms that mitigate credit market failures arising from informational asymmetries. This context has narrowed the focus of study to only those relationships between SMEs and banks that include credit services or only to the credit service component of a multi-product relationship. This emphasis is not surprising given that current theories of financial intermediation emphasize banks' unique ability to produce and process information on the risk characteristics of otherwise highly opaque borrowers.⁵⁸

The narrow focus of study on credit has come, however, at the expense of ignoring a broader set of forces that could give rise to relationships in markets where small businesses contract for a broad range of credit and non-credit services. Besides narrowing the focus of the discussion in this way, the credit-oriented view of relationships has also left the literature with a highly stylized view of the phenomenon. In his review of the relationship banking literature, Boot (2000) notes that "... relationship banking [is] not particularly sharply defined" and that "this lack of definitional sharpness is compounded by a lack of descriptive rigor".⁵⁹

To illustrate the lack of definitional clarity engendered by the credit orientation of the literature, it is useful to briefly summarize some of the efforts to define or characterize relationships. In a very early paper, Carry (1817) defined a relationship as a "closeness" that induces banks to "lean against the wind" when their borrowers suffer

⁵⁸ See, for example, Leland and Pyle (1977); Diamond (1984); Ramakrishna and Thakor (1984); Fama (1985); or Boyd and Prescott (1986).

⁵⁹ A February 22, 2012 search on the phrase "Bank relationships" in EconLit & Business Source Complete generated 4852 references.

adverse business shocks. Much more recently, Fama (1985) concludes that banks' informational expertise makes them "inside debt holders" even when providing credit to transparent, publicly traded businesses. Ongena (2001) describes relationships as a "kinship" between the bank and its borrowing customer. Petersen and Rajan (1994) add the dimension of time by emphasizing that relationships involve a "close and continued interaction" between the bank and its business borrowers. In further describing these interactions, Rajan (1998) notes that relationships are "not transaction driven." Ongena and Smith (2000) have embellished this theme by emphasizing that relationships are "the connection between a bank and customer [that]...goes beyond the execution of simple, anonymous, financial transactions." Finally, Cole et al (2004) note the important differences between loans that are underwritten based on the soft information generated within relationships and "cookie cutter" loans that are the product of a more objective, formula driven approach to screening credit demands.

The important point for purposes here is that all of these observations are based on a theoretical framework which emphasizes how and why financial intermediation arises naturally in credit markets. These models generate relationships in the form of repeated credit contracting between informationally-opaque small businesses and banks that specialize in lending to these types of borrowers.⁶⁰ A common theme in this theoretical literature is that the incumbent bank obtains proprietary information on the true risk characteristics of the borrowers it deals with. This stock of proprietary

⁶⁰ There is an earlier relationship literature that addresses interactions between depository accounts and loan outcomes: Hodgman (1963), Kane and Malkiel (1965), and Nakamura (1993). This literature studies the scope economies that arose from "reg Q" limitations on interest rates banks could pay on commercial deposits.

information gives the incumbent bank a comparative advantage when re-contracting credit with an existing borrower so that relationships arise because they allow the bank and borrower to share informational rents over time. Examples of these contributions include Wood (1975), Fama (1985), Sharp (1990), Boot and Thakor (1992), Greenbaum, Kanastas and Venezia (1993), Greenbaum and Thakor (1995), and Baas and Schrooten (2006). The emphasis on inter-temporal rent sharing in these models leads naturally to an emphasis on duration as an empirical proxy for the amount of proprietary information, and so the strength and value, of the relationship between the bank and its small business customer.

The empirical examination of small business-bank relationships has been shaped and motivated in large part by these same theoretical insights. The primary focus of this work has been to examine the effect of relationship strength on outcomes in the small business loan market such as loan interest rates, loan amounts, the propensity for collateral use and the probability that a requested loan is approved. Nearly all of these studies for the U.S. have used the duration of the SME-lender relationship (or its log) as the primary mechanism through which relationships influences the loan terms.⁶¹

Prominent examples of this approach include Berger and Udell (1995) and Brick and Palia (2007) who examine the impact of duration on the interest rates and collateral requirements for lines of credit to small businesses. Other investigators rely as heavily on duration measures, but supplement the empirical model with information about

⁶¹ All U.S. studies have used the SSBF as I do. There is an extensive, parallel literature that studies these outcomes using data from throughout Europe, most of Asia and a large part of South America.

services in the relationship other than credit. Petersen and Rajan (1994), for example, include not only duration to measure the impact of relationship strength on the terms for lines of credit, but also indicators for whether the small business also has a checking or, savings account with the bank. These authors also control for relationship exclusivity by including the percentage of the firm's external capital provided by the lender. Cole (1998) adds dummies for four service types and a measure of credit relationship exclusivity to duration in his examination of the factors which determine the probability of success when a small business applies for a line of credit. Finally, both Chatraborty and Hu (2006) and Chatraborty et. al. (2010), include counts of the number of credit and non-credit services used by the SME as well as duration in their examinations of the forces that determine loan terms and collateral requirements for small business.

Even when non-credit dimensions of relationships are recognized in this way, their impact is assumed to be linked only to the additional proprietary information about the borrower that can be extracted when the scope of the relationship is expanded. In this essay I develop a more comprehensive and systematic method of categorizing and measuring the strength of small business-bank relationships. The objective of this essay is to show that a broader view of relationships between SMEs and their providers of financial service can contribute to a richer appreciation of the complex mechanisms which lead to the formation of relationships that endure over time and that span a range of services.

Data on Small Business Financial Relationships

In this essay I use the four Surveys of Small Business Finances conducted under the sponsorship of the Federal Reserve Board in 1988, 1993, 1998, and 2003. The Survey of Small Business Finances (SSBF) is the only publicly available data set that combines extensive small business financial statement and governance information with detailed information on the use of both credit and non-credit financial services. The surveys also provide information on the providers of financial services used by each small business. The public version of the 2003 SSBF was released by the Board of Governors of the Federal Reserve System in November, 2006. It contains 4240 observations of small businesses based on a sampling frame of domestic non-financial, non-agricultural, for-profit businesses with fewer than 500 employees. The sample design is a stratified random sample with over-sampling of firms having 20 to 499 employees in order to facilitate research on larger firms. As a result, however, sample weights must be used to estimate population statistics. The 1988, 1993, and 1998 surveys contain, respectively, 3224, 4637, and 3561 observations on small businesses and have a similar sample design. The SSBF data, in fact, is sufficiently similar across all surveys so that consistent measures of relationship structure, relationship duration, and many firm, ownership, governance, and market characteristics can be obtained for all four years.⁶²

⁶² Due to the expense of conducting this survey, the Fed has indicated that it has no plans for additional SSBF surveys.

The structure of the small business surveys is ideal for the study of relationships between SMEs and their institutional providers of financial services.⁶³ The survey not only identifies the full range of both credit and non-credit financial services used by each firm, but also provides the identity of the financial institution from which it was obtained. For each provider of financial services, the public version of the survey identifies its institutional type (such as bank, thrift, credit union, brokerage firm, insurance company, etc.), its geographic proximity to the main office of the business, and the length of time that the SME has done business with that financial service provider. Of particular importance to this study, each SME in the survey was also asked to identify the particular provider that it regarded as its primary or most important source of financial services. This information is used throughout this essay to identify the “lead bank relationship” for each SME.

The SSBF provides a wealth of information about the characteristics of firms. In the 2003 survey for example, the average age of firms under current ownership is 16

⁶³ One of the few shortcomings of the SSBF data is that it includes no information on the entities that provide the SMEs with trade credit. As a result, this essay focuses on the multi-financial product nature of relationships between firms and financial intermediaries, rather than on SMEs and their industrial suppliers. In addition to providing physical inputs to SME production functions, these trade suppliers who offer extended payment terms can be an important source of working capital finance. There are a range of theories that seek to explain why suppliers offer trade credit in addition to the provision of goods. (See, for example, Petersen and Rajan (1997)) Several of these theories emphasize the roll of trade suppliers as financial intermediaries. Incorporating trade creditors as potential “lead bank” relationships in this study of the product composition (scope), duration, and exclusivity of multiproduct financial relationships, would confuse rather than enrich the analysis. What is interesting, however, is the impact that trade creditors might have on the benefits of lead bank relationships and the observable characteristics of their scope, duration, and exclusivity. Some theories of trade credit suggest that trade credit substitutes for institutional sources of external working capital finance, particularly for young and for riskier firms. Empirical studies have found evidence for this substitution effect. The empirical analysis of lead bank relationship duration in *The Empirical Correlates of Lead Bank Relationships, 1988-2003*, therefore, includes a right-hand-side indicator variable for the presence of trade credit.

years, 83 percent of the firms are family owned, and 89 percent are managed by an individual who is one of the three primary owners of the business.⁶⁴ Other characteristics of each firm that are provided in the surveys that will be used extensively here include asset size, industrial classification, rural/urban location, the competitive/non-competitive status of its local banking market, legal governance structure, and the number of locations from which each firm operates.

To get a feel for the businesses examined here, Table 3.1 shows a variety of descriptive statistics. Businesses in the sample are generally very small, as more than 50 percent of the sample firms in each year have less than \$100,000 in assets. The firms also come from a wide range of industries including retail, wholesale, construction, manufacturing and services, the largest of all industrial groupings. As mentioned earlier, firms in the survey were asked to identify their primary or “lead” provider of financial services. Table 3.1 shows the distribution of lead financial service providers in each survey year. In 2003, 84 percent of the firms indicated that a commercial bank was their primary source of financial services and another 13 percent identified a thrift or credit union. In 1988, 91 percent of the small business indicated that a commercial bank was their primary source of financial services and 6 percent identified a thrift or credit union. Because of the dominance of these depository institutions as lead banks, I refer in this essay to the relationship between the SME and its most important provider of financial services as the “lead bank relationships” even though some “primary providers” are not, in fact, depository financial institutions.

⁶⁴ The distribution of firm age is modestly skewed. The median age of firms sampled is 14 years.

The Use of Financial Products by Small Businesses

The SSBF provides information on small business use of fourteen separate types of financial services: checking accounts, transactional services, cash management services, the processing of credit card receipts, seven types of external credit access (lines of credit, equipment loans, finance leases, etc.), savings accounts, corporate trust services, and brokerage accounts.⁶⁵ The SSBF surveys also indicate the number of institutions from which each product is obtained and provides the means to associate each product used with the institution(s) from which it is obtained.

In this section I describe the fourteen products and combine them into three broad functional categories -- payment services, investment services, and credit services. I argue that this classification scheme reduces the dimensions needed to measure the scope of financial services provided to SMEs while maintaining functional homogeneity. I then use these three categories to examine the combinations of financial services that are used by SMEs without reference to the financial institution or institutions that provide them. The next section of the paper looks within these multi-product use patterns to examine the extent to which an SME contracts for them with, and only with, its lead bank.

Three Categories of Financial Products

The analytical approach taken here is related to that of Prager and Wolken (2008). Their study uses data on financial product use from the 1998 and 2003 SSBF to study the

⁶⁵ In the 1998 and 1993 surveys, credit card processing services are included in the transactions category. The 1988 survey provides usage indicators for sixteen product types.

propensity of SMEs to use community banks as a source of financial services.⁶⁶ They use the data, however, by counting the number of the fourteen financial services used by each SME as a measure of the “intensity of service use.” They also aggregate these products into three broad categories of deposit services, credit services, and financial services. These three service categories are then used to create (non-exclusive) subsamples which Prager and Wolken use to identify determinants of the likelihood that an SME will contract with a community bank for at least one of the services in that category.

Like Prager and Wolker, I organize the fourteen financial service products into three different broad financial service categories. The groupings I use, however, reflect similarities in the functions that each product provides: Those that are used to make and receive payments, those that provide external debt capital, and those that facilitate investment of excess funds. In general, services within each category can be thought of as substitutes or complements. Across categories, however, services are generally unrelated. Below I discuss each of the three product categories in more detail before examining how frequently small businesses use combinations of these categories.

Payment services consist of checking accounts, other payment services (night deposits, coin and currency, and wire transfers), credit and debit card processing, and cash management products. Transaction services share a common association with the firm’s need to receive process and disburse payments from customers and to suppliers.

⁶⁶ The public version of the SSBF does not contain the asset size data on banks used from which Prager and Wolken were able to classify banks as community banks.

Payment services are the most prevalent class of services since substantially all firms use at least a checking account.⁶⁷ Beyond the ubiquitous checking account are transactional services, such as coin and currency processing and night depository, that are of particular importance to retail firms, and wire transfers that permit rapid, non-conditional payments. Card processing services are used by almost all retailers to facilitate the collection of payments from credit card sales. Cash management services, such as lock box, remote disbursement, and sweep account products, reduce the opportunity costs of funds tied up in the payment process for larger businesses. Table 3.4 summarizes the number of firms using each type of payment services in the 2003 SSBF and shows the type of institution from which it is obtained. Checking account use is, as expected, ubiquitous. Quite naturally, depository institutions are the providers of substantially all payment services. The one exception is the use of specialized vendors for credit card processing.

Credit services include all contractually repayable external debt capital raised from financial institutions.⁶⁸ The seven categories of credit services in the SSBF are lines of credit, mortgage loans, equipment loans, vehicle loans, other loans, capital leases, and credit related services. The credit related services category includes specialized credit instruments, such as acceptances and commercial letters of credit used to finance international trade, and sales finance and factoring services used predominantly by larger wholesalers and manufacturing firms.

⁶⁷ A more interesting question is what type of small business does not have any transactional services. The data indicates that the 3 percent of firms with no transactional services are businesses with limited assets that have limited reported sales activity, and apparently, deal in cash.

⁶⁸ Trade credit (accounts payable) is excluded by this definition. Since my focus is on institutional relationships, I also exclude loans from the owner and family members when constructing relationship types and their measures.

The empirical relationship literature distinguishes between lines of credit and the other loan types that are generally defined by purpose and type of collateral. Most of these other loans are non-revolving and structured as amortizing term loans. Lines of credit, in contrast, are revolving loan commitments, typically extending for one year periods, which incorporate a wider range of credit enhancement structures. Lines of credit are the major source of external debt capital in the 2003 SSBF and are used by an estimated 60 percent of small business in the 2003 SSBF frame. Table 3.5 summarizes the number and source types of credit services used by firms in the 2003 SSBF sample. It is interesting that no individual credit product is used by even half the firms in the 2003 survey. Depository institutions dominate the provision of lines of credit, mortgage loans and credit services, and are the primary source of equipment and other loans. Commercial finance and captive finance companies are important sources of vehicle loans, equipment loans and leases.

Investment services include trust and pension services, brokerage services, and savings services. These services provide for both the short term investment of excess business funds in instruments such as certificates of deposits and commercial money market accounts, as well as the longer term investment of funds for the benefit of employees and retirees in pension and 401K funds. Only 28 percent of the small businesses surveyed in 2003 used an investment service and these were most likely provided by non-depository institutions, such as brokerage firms and insurance

companies, that frequently sell 401K and SEP plans to small businesses. As indicated in Table 3.6, investment products is the least frequently used product category in the 2003 SME financial services market.

Table 3.7 summarizes the population point estimate of the proportion of firms using each of these three categories of services in each SSBF survey. Not surprisingly, payment services of some type are used by nearly all small businesses in all years. The use of investment services, on the other hand, has trended up over time. Least stable of the three broad categories was credit services, which the literature has emphasized is key to small business-bank relationships. The number of SMEs using credit services decreased by one-sixth between 1988 and 1998, but more than half of the decrease was reversed by 2003.

Patterns in the Scope of Financial Service Use by Small Businesses

I have identified three broad categories of financial products in order to measure the breadth or scope of financial service use by small businesses. To do so, I first examined all seven possible combinations of the three product types: payments only, credit only, investments only, payments and credit, payments and investments, investments and credit, and all three services. It turns out that in each of the four SSBF surveys two of the combinations occur rarely: investments only, and credit and investments.

Henceforth, I combine these two with the “no service reported” category so that the scope of small business financial product use is captured by one of the following five, mutually exclusive patterns of service use:

- 1) Payment services only
- 2) Payment and Credit services only
- 3) Payment and Investment services only
- 4) All three service categories: payment, credit, and investment
- 5) Credit only

It is important to emphasize that the combinations defined in this section do not take into account the number of providers that supplied the financial products to each small business. Here we simply measure the scope of service use without regard to the provider(s) of these services.

Table 3.8 provides estimates of the unconditional prevalence firms with these patterns of service use in the U.S. small business population for the years 1988, 1993, 1998 and 2003. The proportion of small businesses that do not use credit services rose from a low of 33 percent in 1988 to more than 40 percent ten years later, before falling back to just above one-third in 2003. The many firms that use only non-credit services have been systematically omitted in prior examinations of SME-bank relationship because the literature has been focused solely on the benefits that relationships bring within credit transactions. In contrast, they will play an important role here.

Defining and Measuring SME Relationships with Their Lead Bank

The previous section looked at the pattern of SME financial service use without reference to the particular institutions from which services were obtained. In this section I take advantage of the fact that the Surveys of Small Business Finance report the provider of each service used by an SME and designate the one provider that each SME identified as its primary or “lead bank.” In this section I examine the distribution of relationships between SMEs and their lead banks across the categories defined in the previous section: payments only, payments and credit, payments and investments, payments, credit and investments, credit only, and the small category of no service or other service profiles. I show that the patterns in these service profiles vary across different size and industry groups and examine two key measures of the strength of these lead bank relationships, duration and exclusivity. This latter measure arises naturally within the framework developed in *The Use of Financial Products by Small Businesses* and *Defining and Measuring SME Relationships with Their Lead Bank* and is new to the literature.

I have pointed out earlier that credit services have up to now dominated the literature on SME-bank relationships. In this section, I begin to make the case that these relationships might also be explained by the transactions costs and economies of scope that are associated with the demand for and supply of banking services other than credit. Small businesses can reduce transactions costs, for example, by establishing and maintaining payment services with a lead bank that is conveniently located. Banks, on

the other hand, could realize economies of scope by bundling payment and investment services. Such factors could be important to our view of SME-bank relationships if it turns out, for example, that SMEs form persistent relationships with banks that do not supply them with credit services.

Table 3.9 establishes, in fact, that the majority of SME-lead bank relationships did not include credit services in all four survey years. Lead banks provided SMEs with credit services most frequently in 1988, but even then the combined share of relationships that included credit only, payments and credit, or payments, credit, and investment services was only 46 percent. The share of profiles that include credit then fell to 39 percent in 1993 and even lower in 1998 and 2003. In contrast, we saw in the last section that two-thirds of SMEs contract for credit services with some financial institution. The clear implication, of course, is that many SMEs seek credit from institutions other than their self-designated lead bank.

The surprisingly low prevalence of credit services in lead bank relationships could indicate that SMEs did not apply this designation to the relationship that generated the largest amount of “informational rents” in its credit relationships. But the high prevalence of “payment services only” within lead bank relationships suggests that something else might be at work. It appears, in particular, that SMEs derive substantive value from ongoing and repeated interactions with banks even if credit is not part of the relationship. This represents a first indication that the literature has been focused on an

incomplete or even misleading interpretation by emphasizing that the value of relationships are driven only by credit services.

It turns out that the importance of credit in the lead bank relationship varies systematically with firm size. Table 3.10 reports the distribution for 2003 of lead bank relationship types for seven asset size strata as well as the non-stratified proportion estimates for the entire population in the far right column. The table clearly shows that the scope of SME relationships increases with asset size.⁶⁹ The modal type of relationship for the smallest firms is payments only, but its share decreases sharply with asset size. At the same time, lead relationships that span payment, credit and investment services are more common among larger firms — these multi-product combinations are rare in the 0-\$25million asset category, but common in firms with more than \$10 million of assets. Relationships combining credit with payments also tend to increase with firm size, but only until assets reach somewhere between \$500,000 and \$2,000,000.

Table 3.11 shows that the distribution of types of lead bank relationships also varies across industrial classifications. Manufacturing and transportation firms generally require significant investments in plant, equipment, and vehicles, and 54 percent of these SMEs use their lead bank as a source of credit. Service firms, on the other hand, generally lease office space, have limited needs for fixed assets and so, as shown in the table, are much less likely to receive credit services from their lead bank. The proportion of lead bank relationships that include credit services lies between these two extremes for

⁶⁹ Prager and Wolken (2008) report similar evidence in their study of community bank use; larger SMEs tend to use more types of services, more of each type of service and more service providers.

small businesses engaged in construction, wholesale, and retail services. These empirical patterns suggest that the forces that lead to the formation of different types of lead bank relationships are multi-faceted and complex.

In the informational paradigm that dominates this literature, duration of the SME-bank relationship has been interpreted as “reflecting the private information available only to the potential lender” (Berger and Udall (1995)). It is not surprising, therefore, that duration has served as the primary measure of relationship closeness or strength in the empirical literature. It has not, however, been systematically examined for relationships that do not include credit. Table 3.12 rectifies this oversight by reporting the mean lead bank relationship duration for each relationship type in each of the four SSBF surveys. Several interesting patterns emerge. First, lead bank relationship duration is shortest for credit-only lead bank relationships in all survey years. Secondly, the difference between the average duration of payment only and payment and credit relationships is negligible in each survey year. Finally, duration increases in length when investment services are added to the payment-only and payment and credit relationship types. Each of these patterns suggests that the literature’s emphasis on credit elements in SME-bank relationships could be incomplete or even misleading.

Table 3.13 provides information about the exclusivity of these SME-lead bank relationships across all survey years. This second indicator of relationship strength has been derived by calculating the degree to which service use in each category is concentrated with the lead bank. The table shows two different measures of

concentration; the proportion of SMEs in each group that uses its lead bank for each service, and the proportion that uses only its lead bank for all services used.⁷⁰ It turns out, to begin with, that most SMEs deal frequently with more than one bank at a time, so that lead bank relationships are generally maintained as part of a more complex financial network. The exception are SMEs who use payment services only — nearly all of these firms use their lead bank for at least some payment services, and a very high percentage use only their lead bank. In contrast, less than one-half of SMEs that report using credit secured some of each service from their lead banks in all years except 1988. Even smaller shares of these firms used only their lead bank. Across all types of relationship, moreover, the exclusivity of lead bank relationships as measured here decrease over time, and decreased monotonically in all categories that include borrowing.

The remainder of the essay focuses on three stylized facts that have emerged from the analysis of this section. First, most relationships between SMEs and their lead banks do not include credit services. Second, there is no clear difference between the duration of SME-lead bank relationships that include credit and those that do not. Third, it appears that the strength of SME-lead bank relationships as measured both by duration and exclusivity generally decreased between 1988 and 2003. Taken together these patterns suggest that the credit-only view of small business bank relationships that has dominated the literature excludes interesting alternative explanations of SME-bank relationships that are changing in importance over time.

⁷⁰ Comparing the percentages in the first line of each panel in Table 3.13 to those in Table 3.9 can be confusing. The top line for each “panel” in Table 3.13 reports the percent of all firms that use only payment services regardless of provider. The top row in Table 3.9 shows the percent of firms whose lead bank provides only payment services.

The Empirical Correlates of Durations of Lead Bank Relationships, 1988-2003

In this section, I examine the correlates of the duration of the relationships between SMEs and their lead banks as measured in the Surveys of Small Business Finance. The analysis is designed to address three research questions that are suggested by the patterns reported in the previous section. First, does the duration of the relationship between SMEs and their lead banks depend positively, or at all, on the presence of credit services? Second, do forces other than the mitigation of informational asymmetries in credit transactions matter in the formation and maintenance of relationships? Finally, does the decrease in relationship duration over time shown in Table 3.12 remain after controlling for a variety of SME and market characteristics? I answer each of these questions by examining the statistical relationship between relationship duration and a variety of firm-specific and market-wide factors that are likely to influence it.

There is much to be gained from a consideration of these three questions. To begin with, it provides an opportunity to assess the relevance of the information-based credit paradigm has dominated the literature with other feasible explanations for the temporal persistence in the relationships between small businesses and their lead banks. Factors such as the search costs involved in locating alternative providers of servicers, costs associated with switching to a new provider, and scope economies in the use and provision of different types of financial services are likely to be at work in the SME market for financial services. Individually and jointly these other factors (referred to

hereafter as transaction costs) should lead to both repeated interactions between firms and their banks over time and to the procurement of multiple financial services that is concentrated at one or, at most, a few financial intermediaries. We have seen evidence in the last two sections that persistent relationships are the norm throughout the SME banking market and not just in the market for credit services. Though these alternative mechanisms are occasionally acknowledged in the SME relationship literature, they have not, to my knowledge, been systematically examined.⁷¹

The research below also provides an opportunity to examine the possibility that the value of credit-based relationships has declined over the fifteen years spanned by the 1988-2003 SSBFs. Despite the formation of new community banks at historically high rates, merger and acquisition activity in the U.S. banking industry caused the net number of bank charters to fall by almost 40 percent. Such changes in the institutional structure in the supply side of the SME credit market must have reduced stocks of proprietary information upon which credit based relationships depend. At this same time, larger banking firms developed and began to adopt credit scoring models as a means of assessing small business credit risk scoring (Berger et al. (2005); Stein (2002)).⁷² The formulaic screening approach eschews the use of proprietary information generated through relationships in favor of objective data. The combination of these forces could

⁷¹ Several studies in the 1970s look at relationships in the context of deposit-loan ties in which bank rents on deposit accounts arising from Regulation Q interest rate limits are shared with borrowers in the form of lower loan rates and/or improved credit access during tight money. There is a more developed literature that links consumer bank relationships to convenience factors

⁷² Frame et al (2001) report that 63 percent of the 200 largest US banks were using Small Business Credit Scoring by January of 1998.

have made information-based relationships less prevalent and valuable in the SME banking market between 1998 and 2003.

These issues and questions are not just of academic importance, they also should inform policy discussion. There has been concern, for example, about the impact that bank consolidation has on the amount and terms of credit for small business because of the special role that independent, local banks play in providing “relationship banking.” If these relationships arise for reasons that are non-informational, however, that concern might be misplaced. In this case mergers between institutions serving different geographic markets may take advantage of economies of scale and scope that actually decrease cost and increase services to the SME market.

Data and Methods

In the analysis presented below I use the duration of the relationship between each SME and its lead bank as the dependent variable. In doing so I interpret duration as a measure of the benefits associated with repeated interactions between the parties, as does most of the existing empirical literature. I depart from that literature, however, in two important ways. To begin with, I focus on duration as an outcome that is influenced by the interaction of a wide range of observable and unobservable characteristics of the firm, its lead bank, their owners and managers, and the markets in which they operate. In contrast, the existing literature uses duration as explanatory variables in regressions that are designed to explain variations in the cost and availability of credit. Second, I

examine the determinants of duration for all types of relationships whereas previous work has generally examined its impacts only for relationships that include credit transactions.

The analysis presented here employs linear multiple regression to estimate the partial correlation between duration and a range of firm, ownership and market characteristics. Since I am also interested in the average change in duration between surveys, I also add survey year dummy variables. It is common within the empirical relationship literature to use this approach, especially when using the SSBF which is not a true panel survey. Like the rest of the literature, therefore, I avoid attaching causal interpretations to the results of the analysis. The goal, instead, is to identify patterns in the data which help to characterize the influences and mechanisms that determine the duration of the observed relationships between small businesses and their lead banks.

The general form of the regression model I estimate is $D_{it} = X_{it}\beta + n_t\alpha + e_{it}$ where: D_{it} is the duration of the relationship between the SME and its lead bank for firm i in survey t ; X_{it} is a vector of observed firm, owner and market characteristics for firm i in survey t ; n_t is an indicator for the year of the survey ; e_{it} represents the effects of unobserved characteristics on the observed measure of relationship strength; and β , and n are the coefficients to be estimated. The coefficient vector $\hat{\beta}$ can be interpreted as the average partial effect of X on relationship duration across all surveys. The coefficient vector \hat{n} gives the average residual change in the average lead relationship duration after controlling for all other factors in X . They are measured relative to the average for the original 1988 sample.

The regressions are estimated on pooled data from the four SSBFs, 1988, 1993, 1998 and 2003 which represents a sample of 15,112 distinct SME-lead bank relationships. These observations represent all of the observations in the four SSBF surveys except for 331 SMEs that reported using no financial services, 129 that reported using an individual as their lead source of financial services, 14 that reported using a government agency as their lead provider and 33 firms that did not identify a “lead” bank. These exclusions comprise less than 3 percent of all observations in the combined surveys. I also exclude the small number of observations (less than 0.5 percent) with missing values for the duration of the lead bank relationship. There are also a large number of SMEs that report a relationship duration with their lead bank greater than their own age; in these cases duration has been set to the firm’s age.⁷³ Finally, because of differences in sampling strategies across the four surveys, weights are applied to all of the samples used in the regressions.

The explanatory variables in the regression are firm, governance, and market characteristics that could influence the net benefits that accrue in these relationships and, hence, their duration. The variables are common in the relationship literature and are consistently defined and measured across the four SSBFs. Firm characteristics are firm age, industrial classification, asset size, an indicator for multiple operating locations, an indicator for operating with unlimited liability, and an indicator for the use of trade credit.

⁷³ The majority of the instances in which lead bank relationship duration exceeds the age of the business are for firms with ages under five years. Analysis of these observations suggests that owners of small business start-ups and acquisitions have used banks with which they had pre-existing relationships as the lead banks for their new ventures. This phenomenon is consistent with both transaction cost and informational rationale for the formation and maintenance of long term bank relationships.

The two governance variables are indicators for owner management and for family ownership. The two market characteristics in the specification are also indicator variables — one which designates firms that are located in a competitive banking market and a second for those located in a rural county. Summary statistics for the explanatory variables are provided in Table 3.14.

Firm age is an important explanatory variable in these regressions because it controls for both the lower and upper bound of relationship duration for a given SME-lead bank pair. Its estimated coefficient, moreover, measures the average linear effect of an additional year of firm existence on the duration of the relationship. I interpret this coefficient, therefore, as an indicator of the average tendency within the sample for relationships to persist as the SME ages.

The specification also controls for the industrial classifications of the SME. These are categorized here, as they were above, into construction, services, retail, wholesale, and, the omitted group, all other. We have seen that relationship types as measured by financial services product profiles vary substantially across these different industrial classifications. However, these complex patterns do not map easily into specific predictions about whether relationships within any given industry should have higher or lower duration than the omitted “all other” group. It is important, nonetheless, to control for potential industry-specific impacts with fixed effects.

Three governance/ownership characteristics — owner management, unlimited liability, and family ownership — have been linked to informational rationales for

relationships in the literature. Firms managed by their owner(s), for example, have less need to generate objective, verifiable financial information than do firms managed by hired, professional manager/agents. These types of firms, as a result, tend to be informationally-opaque to external investors. Firms organized with unlimited liability (proprietorships and general partnerships) present external investors with a different problem — a minimal separation between the profit object of the business and the personal utility function of its ownership. For these reasons moral hazard tends to be a particularly important constraint in raising external funds for owner-managed and unlimited liability firms. It is likely, as a result, that the value and, therefore, the duration of bank relationships will be high for both types of firms.

Family owned firms, even if operating under limited liability, are likely to have informational characteristics similar to those for proprietorships and unlimited partnerships because there is even less need to generate formal records of financial performance in organizations where closely-related individuals share risks and rewards. It becomes more costly, as a result, for such firms to produce information for an outside creditor, and these high fixed costs should lead them to form longer-term and more persistent relationships with a lead bank. As a result, I expect the estimated coefficient to be positive on all of the governance indicators, and particularly so in a subsample of lead bank relationships whose scope includes credit services.

Two other firm characteristics are included in the regression to control for variations in the transactions costs of locating and establishing a relationship with a lead

bank. Firm size as measured by total assets would lower the relative impact of any fixed cost that must be borne when establishing a relationship, so I expect its estimated impact on duration to be negative.⁷⁴ I also include an indicator variable that designates firms that operate out of multiple locations to control for the added complexity and cost they face in establishing and in switching lead banks. Since credit and investment services are generally managed at the firm's headquarters location, I expect the impact of that the impact of multiple locations to operate primarily through the costs involved in switching payment services to a new bank. As a result, the coefficient on multiple locations is expected to be positive and particularly important for firms that use their lead bank for payment services.

Two characteristics of local banking markets are incorporated to capture the impact of factors that affect the costs and benefits of SME-bank relationships for all firms that operate within these spatial boundaries. The first indicates whether the SME's banking market is considered by regulators to be competitive; I presume that there are more and less costly opportunities to change lead banks in such a market.⁷⁵ I also control for whether the main office of each firm is located outside of a Metropolitan Statistical Area as defined by the U.S. Census. I interpret this indicator of a "rural" banking market to be associated with greater distances between alternative potential financial service providers and, therefore, higher transactions costs of switching lead banks than in more

⁷⁴ In the unconditional analysis in section IV, we found that the lead bank relationships of larger firms exhibited less exclusivity than those of smaller firms.

⁷⁵ A competitive market is one with a Herfindahl index value of less than 1800. Above this value, regulators consider the market to be concentrated. Due to differences in data across surveys, I use the bank only Herfindahl index and the 1800 threshold to define a competitive market for financial services.

dense, urban markets. The effects of both competitive and rural banking markets are expected to be independent of the types of services used within a relationship.

A trade credit variable is included to see if access to trade credit has a systematic effect on lead bank relationship duration. A negative and statistically significant coefficient would suggest that access to trade credit is a substitute for bank relationships and reduces their importance. Conversely, a positive and statistically significant coefficient would suggest either that access to trade credit complements bank relationships or that one of the benefits associated with a strong bank relationship is increased access to trade credit. The empirical relationship literature has supported the latter association especially in relationships that include credit services.⁷⁶

I report three different versions of the empirical duration model. The first estimates the model for the pooled sample of all SME-lead bank relationships in all years. This full sample model provides estimates of factors that are correlated with duration across the entire spectrum of relationship types, industrial classifications, firm characteristics, market settings, and time. Notably absent from these regressions are controls for the types of relationships as defined by their product mixes. The earlier descriptive analysis showed that relationship scope is correlated with several of the explanatory variables included in these regressions, such as industry and firm size. Preliminary analysis revealed that including separate controls for relationship type did

⁷⁶ Some research indicates that this effect differs by firm age. Trade credit substitutes for bank working capital finance in younger, more opaque firms. Later, bank credit enables firms to obtain trade credit on more favorable terms.

not change the important results in the empirical models, and so the results including them are not reported below.⁷⁷

I also report two sets of regression results for distinct subsamples of the data — one for firms younger than five years in age and older firms, and another for firms with relationships that include credit separately from those that do not. The rationale for running fully interacted versions of the model across age categories is to assess whether the complex informational dynamics associated with the maturation of a firm over time has a substantial change on the factors associated with duration. The literature associates increase age with an increase in “reputation” or a track record that reduces informational opacity (Diamond, 1989). The lack of reputation causes young firms to be more informationally opaque. Estimating the model separately for relationships that involve credit transactions, on the other hand, provides evidence about the stylized assumption that has driven much of the existing literature — are the benefits of SME-bank relationships as measured by duration due primarily to informational problems in the SME credit market?

Full Sample Results

Table 3.15 reports the results of the regression analysis for the full sample of pooled cross sectional data.⁷⁸ Model 1 shows the unconditional change in the mean average length of all lead bank relationships relative to its 1988 level. The mean length fell by eight months between 1988 and 1993 and twenty-five months between and 1993

⁷⁷ These results are available upon request.

⁷⁸ Descriptive statistics for the estimating sample are provided in Table 3.14.

and 1998 before increasing by twenty-seven months between 1998 and 2003. Over the full fifteen years spanned by the surveys the survey year fixed effects, relative to the omitted 1988 category, are negative and statistically significant at the 1percent level. Model 2 adds a control for the age of the firm. As expected, the effect of firm age on relationship duration is positive and both economically and statistically significant. The point estimate implies that lead bank relationship increases by six months for each additional year of firm age. The impact of firm age remains stable throughout the remaining models shown in the table. The estimated year fixed effects are also stable across specifications, even after controlling for firm age.

Model 3 adds dummy variables for different industry types. The average effect of industry type on lead bank duration is not different from zero at conventional significance levels for any industrial classification. The absence of any systematic partial correlation between industry type and duration is surprising given the variation in the product profiles of these relationships that was identified earlier. This lack of significant industry effects persists in all subsequent specifications.

Models 4 and 5 add the six firm, ownership, and governance variables. The estimated partial effect of firm asset size (in \$1,000,000s) on duration is, as expected, negative and statistically significant at less than the 1percent significance level. The magnitude of this effect, however, is modest with a \$1,000,000 increase asset size being associated with a 21-day decline in average lead bank duration. The estimated effect of operating out of multiple locations for the full sample is negative but not statistically distinguishable from zero at conventional significance levels. I had conjectured that its

effect would be positive, particularly the relationship scope was payments only. The indicator for use of trade credit is also insignificant in all models.

Model 6 adds the indicator variables for a competitive banking market and rural location. It was argued that both market characteristics serve as proxies for transactions cost factors that might explain greater persistence in SME-bank relationships for all types of firms. The results are consistent with these expectations. The partial effect of being located in a more competitive banking market is negative, though not statistically significant.⁷⁹ The partial effect of being located in a rural market, on the other hand, is significant at the 1 percent level and is estimated to increase the duration of lead bank relationships by an average of fifteen months.

The main results of this full sample analysis can be summarized as follows. First, there is evidence that the mean length of lead bank relationships declined strongly between 1988 and 1998 just as bank consolidation and the increased use of credit scoring could have decreased the value of these interactions. The estimated increase in relationship duration in 2003 is not consistent with this interpretation, although this effect does not reverse the overall trend towards shorter duration between 1988 and 2003. These impacts, moreover, are estimated across all relationship types including those that did not include credit services. Second, the impact of firm age is positive, robust and statistically and economically important in the full sample. Third, I find no evidence of a

⁷⁹ Model 6 was also estimated with the rural and competitive variables individually. When only the competitive variable was included, its coefficient was negative and both economically and statistically significant. The rural variable is strongly and positively correlated with the competitive variable (a 0.31 correlation coefficient) and likely masks some the effects of competition in reducing relationship duration.

systematic effect of industry on duration. Given the differences in relationship type across industries that we have seen earlier, it appears that industrial characteristics affect relationship scope without influencing its duration. There was also no apparent association between access to trade credit and lead bank relationship duration.

Finally, the estimated effects of three proxies for transactions cost—firm size, market competition and rural location—were of the expected sign and statistically significant. This suggests that a broad set of transactions costs are important in determining the benefits and duration of relationships.

Analysis of Duration by Age of Firm

Table 3.17 reports results when the model is estimated separately for young (aged five years or less) and for old (aged over 5 years) firms. Recall that the motivation for examining this model is to assess whether the processes affecting duration vary with the age of the firm. These two groups are, in fact, very different as the mean age and lead bank duration for young firms are, respectively, 3.2 and 2.7 years which is much lower than the means of 17.6 and 10.8 years for the older firms.⁸⁰ The younger firm subsample is also much smaller in size and exhibits less variation in duration because this measure is confined to be between zero and five years for these firms.

The signs of the estimated year fixed effects are the same for young and old firms as average duration fell between 1988 and 1993 and between 1993 and 1998 before increasing in 2003. The magnitude of change was much greater for the older firms,

⁸⁰ Summary statistics for the two subsamples are shown in Table 3.16.

however, while the changes in 1993 and 2003 were significant only at lower levels of statistical significance for the younger firms. The latter result is not surprising given the lower variation in duration in the young-firm sample. Moreover, the estimated year effects for younger firms are all of significant size relative to the 1988 base. The mean lead duration for old firms, on the other hand, fell by a full 19 months between 1988 and 1993 and by another 25 months between 1993 and 1998. Though there was an increase in average duration between 1998 and 2003, the duration of the lead bank relationships for older firms decreased by a total of 16 months over the 15 years spanned by the surveys. This pattern suggests that the value of relationships between lead banks and older firms were more likely to have been influenced by bank consolidation, financial deregulation, and changes in small business lending technologies.

A particularly interesting result from the analysis of the two samples is the large difference in the estimated impact of age on duration. For young firms a one year increase in age is associated with a 10 month increase in the duration of the lead bank relationship. For older firms, the same increase in age is associated with only a 5 month increase in duration. Both effects are statistically significant at the 1 percent level. I interpret this as evidence that there is a greater tendency for lead bank relationships to persist for young firms than for those that are older.⁸¹ The estimates also reveal that age explains more of the variation in duration for younger than older firms.⁸² These patterns

⁸¹ This is crudely consistent with Ongena and Smith (2001) who find positive duration dependence for the lead bank relationship duration in a panel of publicly traded Norwegian firms.

⁸² Firm age accounts for 79 percent of the variation in duration for younger firms, and only 42 percent for the older old firms. This is reflected in the R^2 statistics which are 0.60 for the younger and 0.32 for the older firms.

suggest that young firms are relatively informationally-opaque and so find it valuable to remain with their initial bank until they have built a “public” reputation (Diamond (1991)).

Coefficients on two of the ownership-governance variables suggest that informational problems influence the lead bank duration of both young and old firms, but in different ways. Duration is estimated to be seven months longer for older firms that operate as a proprietorship or general partnership, while family ownership is associated with a two month increase in lead bank duration for younger firms. The latter effect is significant at the 1percent level and substantial in size since the average duration of lead bank relationships for these young firms is only thirty-three months. The family ownership control is not significant in the large firm sample, however. This pattern suggests that relationships are particularly important for “new” firms where informational problems are most acute. For neither group is there a systematic association between family governance and duration.

I have argued that firm size, rural location, and multiple office location all proxy for variations in transactions costs that could influence duration. As expected, the effect of asset size is negative and significant within the old firm sample at the 1 percent level. The size of the impact, moreover, is substantial as an increase in asset size of \$1 million is associated with a 2 month reduction in the duration of the lead bank relationship. In contrast, asset size has no significant effect on duration for younger (and generally smaller) firms. In contrast, rural location is associated with an economically and

statistically significant increase in duration for both young and older firm samples which suggests that the transactions costs in less dense markets represent an impediment for switching banks for new as well as established businesses. The coefficient on multiple location, on the other hand, influences duration significantly only for older firms, and then in a direction opposite to its predicted positive effect. The estimated 4 month decline in lead bank relationship duration for this class of firms could reflect that bank consolidation during the era spanned by these surveys created more convenient branch networks that were particularly attractive to SMEs with multiple office locations.

The results of this section suggest that the process generating duration between SMEs and their lead banks differ in important and interesting ways for younger and older firms. For the former group, firm age is of paramount importance. While age also matters for older firms, relationship duration for this group is shaped to a greater degree by firm and market characteristics that are likely to be associated with a broad range of transactions costs that influence the value of setting up and maintaining a lead bank relationship. In addition, the unexplained decreases in average lead bank relationship duration captured here by year fixed effects appear to have been felt primarily by older firms. These firms were most likely to have been affected by the massive changes in the banking industry and the introduction of credit scoring that occurred between 1988 and 2003.

Analysis of Duration for Relationships With and Without Credit

A consistent theme throughout this essay is that the existing literature on SME-bank relationships has been narrowly focused only on credit transactions. To examine the argument more fully, Table 3.19 reports the results of regressions run separately for firms that contract for credit services with their lead banks and those that do not. By grouping the full sample in this way I hope to assess whether the benefits of SME-bank relationships are, as the literature implies, due primarily to informational problems in the SME credit market or if other forces and transactions costs play a role.

Each sub-sample contains approximately half of the observations in the full pooled sample.⁸³ The estimated survey year fixed effects on relationship duration are statistically the same for both sub-samples. Earlier, I argued that bank consolidation and the rapid adoption small business credit scoring should have disproportionately weakened informational rationales for the formation and maintenance of relationship involving credit. Under these assumptions, there should not be similar year effects for relationships that do not include credit. The lack of differences in survey year fixed effects between the two columns of Table 3.19, therefore, can be interpreted as a failure to find empirical evidence that changes in the supply side of the SME financial market were particularly detrimental to the value of relationships based on informational rationales. In addition,

⁸³ The unconditional mean duration of the lead bank relationship for firms that do and do not obtain credit from their lead bank is 8.78 and 8.59 years respectively — these are statistically indistinguishable at a 95 percent confidence level. The unconditional mean age of firms that do not obtain credit from their lead bank is 13.7 years and 14.2 years for those that do borrow from their lead bank. These means are statistically different at a 95 percent confidence level. Summary statistics for the two subsamples are reported in Table 3.18.

the estimated increase in relationship duration due to another year of firm age is greater for the “no credit use” sample (6 months) than it is for the “use credit” sample (only 5 months). The difference is statistically significant and suggests that firms that do not enter credit transactions with their lead bank are more likely to maintain that relationship over time than those that do. This result also calls into question the value of duration as an empirical proxy strictly for the measure of informational benefits of relationships.

In contrast, the coefficients on unlimited liability and family ownership are positive and economically and statistically significant only when lead relationships include credit. Since these variables proxy for the degree of the firm’s informational opacity these results are consistent with informational motivations for relationships.

Finally, effect of a rural market location, which proxies for the transactions costs of changing lead banks, is positive and highly significant for both lead relationships with and without credit. This suggests, as expected, that transactions costs play a significant role in shaping the benefits of maintaining relationships.

Summary of Regression Results

The regression analysis of lead bank relationship duration was designed to address three research questions. The answers, to begin with, is that there is no evidence that duration length is longer when the lead bank supplies credit services to the SME. It appears, instead, that firms whose lead bank relationship scope does not include credit are more likely to maintain their lead bank relationship as they age. Second, the regressions all show evidence that transaction costs are important in determining duration across all

types of lead bank-SME relationships. Rural location, in particular, appears to increase in relationship duration for lead relationships with and without a credit component. I also found evidence, however, that variables associated with greater informational opacity also increased the duration of relationships. All told, the evidence in this section suggests that both informational and transactional mechanisms are operative in generating lead bank relationships that endure over time.

Finally, the evidence shows that the decrease in the average duration of lead bank relationships between 1988 and 2003 decreased even after controlling for characteristics of the firm, its lead bank, and its local market. The regression analysis, moreover, provides two additional insights into this result. First, the decrease in average duration over time appears to have been centered primarily among older firms. Second, the unexplained decrease in duration over time occurred equally in relationships that incorporated credit services, and those that did not. Together these results suggest that the impact of consolidation, financial deregulation, and technical innovations in small business lending on small business-bank relationships was complex and multifaceted.

Summary and Conclusions

This essay can be thought of as a response to Boot's (2000) observation that the relationship banking literature suffers from "a lack of definitional sharpness... compounded by a lack of descriptive rigor." I have used the Survey of Small Business Finances conducted by the Federal Reserve in 1988, 1993, 1998, and 2003 to address this gap in knowledge for the relationships between small-to-medium enterprises (SME) and

their lead provider of financial services. The building blocks of the analysis are the reports made in the surveys by each SME about whether and from whom they contract for the fourteen separate financial services. Each of these was mapped into one of three functionally defined service categories: services that facilitate the making and receipt of payments, credit services that provide external debt capital, and investment services that employ excess funds. A financial services product profile could then be assigned to each SME in the survey as one of the seven possible combinations of these three broad categories of services.

With the data organized in this way, the bank relationship for each SME was defined to be the subset of its total product profile that was supplied by its lead provider of financial services. This approach provides “definitional sharpness” to the literature because it is based on a systematic and comprehensive categorization of the best available empirical evidence for the financial services actually used by SMEs in the U.S. The definitions which dominate the literature on bank relationships, in contrast, are generally based on theoretical rationalizations for repeated contracting in credit services between a SME and a bank. As Boot points out, these highly stylized definitions of relationships become arbitrary when applied in empirical investigations of the much broader and complex portfolio of financial services used by real-world SMEs.

With relationships defined in this manner, this essay has also provided the descriptive rigor Boot called for by characterizing the variation in prevalence of the five different types of relationships across SMEs of different size, across different industries,

and over time. The essay also examined two empirical measures of relationship strength: duration and exclusivity. Duration as measured here as the length of time the lead bank has supplied any financial service to the SME, so it recognizes important complementarities in the provision of different kinds of financial services. Relationship exclusivity, which has generally been ignored in the literature, has a natural definition here — whether or not the SME receives all of the financial services that it uses from only its lead bank. Finally, a reduced form regression analysis was undertaken to characterize the influences that determined the duration of relationships across nearly all of the firms captured in the Surveys of Small Business Finance.

Three main results arise from this analysis. The first is that there is considerable variation in the types and exclusivity of lead bank relationships. The scope of these relationships falls overwhelmingly into four of the possible seven categories: payments only, payments and credit, payments and investments, and all three. Lead bank relationships that consist of credit only, investments only, and credit and investments are rare. Perhaps most strikingly, less than half of all relationships provide access to external credit. The evidence also shows that substantial proportions of SMEs contract for similar types of financial services with providers other than their lead banks. These patterns contradict the stylized fact that has dominated the theoretical literature: SME-bank relationships are strictly bilateral relationships for credit services.

Secondly, I find evidence that both the duration and exclusivity of SME- lead bank relationships declined in the U.S. between 1988 and 2003. In an environment of

bank consolidation, technological innovation and deregulation , the conditional changes in lead bank relationship duration measured by the survey year fixed effects in the regression analyses indicate that relationship duration decreased between 1988 and 1998, increased over the next five years, but on net showed a significant decrease over the entire fifteen period. Though not monotonic across the four surveys, the overall pattern of change suggests a weakening in relationship persistence. Unconditional analysis showed a similar pattern of decline over time in lead bank exclusivity, defined as the percentage of services used that were procured only from the SME's lead bank. An obvious and important area of research identified by this essay, therefore, is to identify the forces that drove the apparent weakening in SME-lead bank relationships after 1988.

Finally, I find evidence that mechanisms other than mitigation of informational asymmetries influence the structure and benefits associated with maintaining relationships. Lead bank relationships persist for all relationship types and there is no evidence that the presence of credit within the scope of lead bank relationship is associated with longer relationship duration. Nor does it appear that relationships involving credit are more likely to persist than are those that do not include credit. Moreover, to the extent that firm asset size and rural location are valid proxies for transactions costs, the regressions provided further evidence that transactions costs as well as informational advantages influence the benefits of SME-lead bank relationships.

The results of this essay indicate that much work remains to be done before we will fully understand the role that relationships play in the SME market for financial

services. These results also suggest that relationship duration, the preeminent empirical proxy for the strength of informationally motivated credit relationships, may also proxy for other mechanisms that influence the benefits obtained from durable relationships between small businesses and their providers of a broad range of financial products. These generalizations have often been set to the side, or simply ignored, as the literature has pursued a model of relationship based only on credit transactions. The evidence presented here suggests that we can learn much more about these relationships by adopting a broader and more integrated perspective of small business finance.

Tables

Table 3.1. Distribution of Firms by Asset Size

Asset Size Range	1988	1993	1998	2003
none	0.10%	0.10%	2.50%	2.60%
0-\$25m	17.60%	29.50%	32.80%	29.10%
\$25m-\$100m	33.00%	28.20%	26.90%	25.70%
\$100m-\$500m	35.00%	27.90%	24.60%	26.00%
\$500m-\$2mm	9.70%	10.00%	9.50%	11.70%
\$2mm-\$10mm	4.10%	3.70%	3.10%	4.00%
Over \$10mm	0.60%	0.70%	0.60%	1.00%
Totals	100.00%	100.00%	100.00%	100.00%

Notes: Sampling weights used to obtain population estimates.

No adjustments made for changes in price levels between surveys.

Table 3.2. Distribution of Firms by Detailed Industrial Classification

Classification	1988	1993	1988	2003
Mining & Drilling	0.70%	0.50%	0.40%	0.30%
Construction	12.50%	13.60%	11.50%	11.50%
Transport & Communications	9.10%	8.10%	8.40%	7.10%
Manufacturing	2.90%	2.80%	3.70%	3.80%
Wholesale	10.00%	8.50%	7.20%	5.90%
Retail	26.40%	21.70%	19.00%	18.40%
Finance, Insurance, & RE	6.80%	7.10%	6.50%	7.20%
Professional Services	9.60%	15.10%	15.00%	16.90%
Other Services	22.00%	22.60%	28.30%	28.90%
Total	100.00%	100.00%	100.00%	100.00%

Notes: Based on 2 digit sic codes. Sampling weights used to obtain population estimates.

Table 3.3. Institution Type of Self Identified Primary Providers of Financial Services				
Lead type	1988	1993	1998	2003
Commercial Bank	91.40%	84.50%	84.30%	82.50%
Thrift*	5.50%	7.70%	6.40%	9.30%
Credit Union	0.80%	2.10%	3.70%	3.50%
Finance Company	0.70%	1.50%	1.90%	1.20%
Brokerage Firm	0.20%	1.00%	0.90%	1.10%
Individual	0.60%	1.50%	1.30%	0.90%
Other Business	0.60%	0.90%	0.60%	0.40%
Other Intermediary	0.20%	0.80%	0.90%	1.20%
Total	100.00%	100.00%	100.00%	100.00%
<p>Notes: Unweighted sample statistics.</p> <p>*Thrift category includes both savings banks and savings & loans.</p> <p>In each survey the small business is asked to identify one provider of financial services that it regards as primary or most important provider. I refer to this provider as the "Lead Bank."</p>				

Table 3.4. Sources and Uses of Payment Services - 2003 Sample

Source type:	Checking	Transactional	Card Processing	Cash Management
Commercial Bank	3594	1772	1036	592
Savings Bank	311	145	62	35
Savings & Loan	38	16	8	0
Credit Union	106	51	9	3
Finance Company	1	6	59	8
Insurance Company	0	0	5	0
Brokerage Firm	30	18	5	21
Leasing Company	0	0	1	0
Mortgage Company	1	0	0	0
Venture Firm or SBIC	0	0	0	0
Other Business - Supplier	2	4	40	4
Owner or Family Member	1	1	0	1
Government Agency	0	0	0	0
Other	3	8	551	1
Service not used	153	2218	2464	3575
n:	4240	4240	4240	4240

Notes: Unweighted sample count of the number of small businesses in the 2003 SSBF that use each service and the primary institution type from which it is procured.

Table 3.5. Sources and Uses of Credit Services from the 2003 Sample

Source type :	Line of Credit	Vehicle Loan	Mortgage Loan	Equipment Loan	Other Loans	Finance Lease	Credit Services
Commercial Bank	1656	475	481	350	199	83	303
Savings Bank	107	42	57	23	9	2	15
Savings & Loan	11	6	14	5	1	0	2
Credit Union	28	86	10	8	4	0	6
Finance Company	65	583	29	161	37	245	26
Insurance Company	3	4	8	0	9	1	0
Brokerage Firm	15	1	5	5	4	2	6
Leasing Company	1	11	0	32	10	161	1
Mortgage Company	6	0	38	2	4	0	0
Venture Firm or SBIC	0	0	1	1	2	0	1
Other Business - Supplier	8	5	2	27	27	43	9
Owner or Family Member	4	8	32	19	183	3	1
Government Agency	4	0	16	4	14	0	0
Other	4	0	4	5	11	12	4
Service not used	2330	3027	3543	3598	3726	3688	3866
n:	4240	4240	4240	4240	4240	4240	4240

Notes: Unweighted sample count of the number of small businesses in the 2003 SSBF that use each type of credit product and the primary institution type from which it is sources.

Table 3.6. Sources and Uses of Investment Services from the 2003 Sample

Source type	Savings Accounts	Trust Services	Brokerage Accounts
Commercial Bank	881	243	51
Savings Bank	74	41	1
Savings & Loan	14	0	0
Credit Union	71	3	1
Finance Company	19	38	13
Insurance Company	7	262	16
Brokerage Firm	105	525	229
Leasing Company	0	2	1
Mortgage Company	0	0	0
Venture Firm or SBIC	1	4	1
Other Business - Supplier	2	75	8
Owner or Family Member	0	101	3
Government Agency	1	0	0
Other	2	13	1
Service not used	3036	2943	3915
n:	4240	4240	4240

Notes: Unweighted sample count of the number of small businesses in the 2003 SSBF that use each type of credit product and the primary institution type from which it is sourced.

Table 3.7. Estimated Population Prevalence of Service Type Usage in Each Survey

Service type	1988	1993	1998	2003
Use Payment Services	98.80%	99.00%	97.50%	97.40%
Use Credit Services	64.80%	59.00%	55.00%	60.40%
Use Investment Services	29.60%	31.40%	31.50%	35.50%

Notes: Shows the proportion of firms in each survey that use at least one service of the type indicated in the rows.

Sample weights are used to estimate population statistics.

Table 3.8. Distribution of the Scope of Service Use: Population Estimates

Service Types Used	1988 n = 3224	1993 n = 4637	1998 n = 3561	2003 n = 4240
Payment & Credit	44.00%	38.10%	33.60%	36.30%
Payment only	24.80%	27.00%	30.20%	24.20%
Payments Credit & Investment	21.40%	20.80%	20.80%	24.40%
Payments & Investment	8.10%	10.20%	10.30%	10.80%
Credit only*	0.50%	0.90%	1.00%	0.50%
No Services/Other**	1.20%	3.10%	4.10%	3.80%

Notes: Sample weights are used to estimate population proportions in each survey year.

Shows the relative frequency with which the scope of small business financial service use spans the categories of payment services, credit services, and investment services.

*Credit only category is shown to facilitate later comparison to Lead Bank Relationships.

**No Services/Other includes the infrequent cases where the SME used no financial services, used only investment services, or used only credit and investment services.

Table 3.9. Distribution of Lead Relationship Scope in All Surveys

Lead Relationship Scope	1988 n = 3224	1993 n = 4637	1998 n = 3561	2003 n = 4240
Payments only	43.10%	47.00%	47.40%	46.90%
Payments & Investments	9.60%	9.80%	10.30%	11.10%
Payments & Credit	32.20%	23.10%	23.30%	26.10%
Payment, Credit, & Invest	10.20%	9.20%	8.40%	8.10%
Credit only	3.20%	6.70%	5.70%	3.20%
No Services/Other*	1.70%	4.20%	4.90%	4.60%

Notes:

*No Services/Other category contains the infrequent cases where the SME used no financial services, used only investments services, or used only credit and investment services.

Sample weights are used to provide estimates of population proportions.

Table 3.10. Distribution of Lead Relationship Type by Asset Size Using the 2003 SSBF

Asset Size: (m = 000)	< 0 n = 75	0 to \$25m n = 873	\$25m to \$100m n = 808	\$100m to \$500m n = 973	\$500m to \$2mm n = 710	\$2mm to \$10mm n = 567	Above \$10mm n = 234	Full Sample n = 4240
No Services/Other*	41.50%	8.90%	1.60%	1.80%	0.60%	0.10%	0.80%	4.60%
Payments only	39.60%	63.50%	51.80%	37.40%	28.10%	24.20%	10.00%	46.90%
Payments & Invest	4.50%	11.00%	12.70%	12.40%	8.20%	7.40%	5.60%	11.10%
Credit only	5.20%	3.10%	1.70%	3.60%	4.50%	6.60%	4.30%	3.20%
Payment & Credit	6.40%	12.00%	25.80%	33.50%	42.90%	42.30%	40.50%	26.10%
All Three	2.70%	1.60%	6.40%	11.30%	15.80%	19.50%	38.70%	8.10%

Notes: Sample weights are used to provide estimates of population proportions.

*No Services/Other category contains the infrequent cases where no financial services were used, where the scope of the lead bank relationship was only investment services, or was credit and investment services.

Table 3.11. Distribution of the Five Primary Lead Relationship Types by Industry Using the 2003 SSBF

Relationship Type	Construction n = 426	Transport & Manufacturing n = 682	Wholesale n = 288	Retail n = 821	Services n = 2019	All Industries n = 4236
Payments only	43.30%	31.80%	42.70%	50.60%	50.20%	46.90%
Payments & Invest	9.20%	11.60%	7.50%	9.20%	12.50%	11.10%
Credit only	2.60%	6.10%	4.00%	2.40%	3.00%	3.20%
Payment & Credit	29.30%	36.00%	31.10%	29.80%	21.40%	26.10%
All Three	12.80%	12.20%	13.10%	4.80%	6.80%	8.10%
No Services/Other*	3.80%	2.40%	1.60%	3.00%	6.10%	4.60%

Notes: Sample weights are used to provide estimates of population proportions.

*No Services/Other category contains the infrequent cases where no financial services were used, and where the scope of the lead bank relationship was only investment services, or just credit and investment services.

Table 3.12. Mean Duration (years) for the Five Primary Lead Relationship Types

Lead Relationship Scope	1988	1993	1998	2003
Payments only	9.8	9.2	6.8	9.1
Payment & Investments	11.6	9.9	7.7	10.0
Credit only	8.1	6.8	5.2	6.0
Payments & Credit	9.2	8.8	6.9	9.4
Pay, Invest, & Credit	9.7	9.7	8.8	10.8
Average Relationship Duration	9.7	9.1	7.0	9.3
Average Firm Age	13.3	14.2	13.4	14.4

Notes: Sample weights are used to obtain estimates of population proportions.

The table excludes the infrequent cases where no financial services were used or where the scope of the lead bank relationship included only investment services or only credit and investment services. In cases where the reported duration of the lead bank relationship exceeded the age of the firm, duration was set equal to the age of the firm.

Table 3.13. Scope and Exclusivity of Lead Relationship by Pattern of Service Use for All Survey Years

	1988	1993	1998	2003
PAYMENT SERVICES ONLY				
% Firms using only payment services*	23.80%	27.00%	30.20%	24.10%
% who use lead bank for some of these services**	23.80%	26.60%	28.90%	23.40%
% using ONLY lead bank for these services***	23.10%	25.00%	28.30%	21.10%
BORROWING & PAYMENT				
% Firms using borrowing and payment services*	39.50%	38.10%	33.60%	36.10%
% who use lead bank for both these service types**	23.50%	17.00%	15.40%	18.40%
% using ONLY lead bank for these services***	20.50%	14.10%	13.80%	9.00%
PAYMENT & INVESTMENT				
% Firms using only payment & investment services*	9.00%	10.20%	10.30%	10.30%
% who use lead bank for both these service types**	3.90%	5.60%	6.20%	5.80%
% using ONLY lead bank for these services***	2.50%	4.40%	5.70%	5.00%
PAYMENT, BORROWING, & INVESTMENT				
% Firms using payment, borrowing, & investment services*	25.90%	20.80%	20.80%	24.40%
% who use lead bank for all these service types**	9.30%	7.30%	7.60%	7.50%
% using ONLY lead bank for these services***	7.00%	5.20%	4.60%	2.40%

Notes: This table summarizes the exclusivity of lead bank relationships for the four primary relationship types.

*Shows the percentage of firms in each survey whose scope of product use is defined by the heading above it

**Shows the percentage of firms whose lead bank relationship scope of the firm's service use

***Shows the percentage of firms who use only their lead bank for all financial services

Percentages are unweighted sample averages.

Table 3.14. Full Sample Regression Means

Variable	Mean	Std. Dev.
Lead Duration (years)	10.30	10.20
Year 1988	0.21	0.41
Year 1993	0.30	0.46
Year 1998	0.22	0.42
Year 2003	0.27	0.44
Firm Age (years)	15.20	12.80
Retail	0.22	0.41
Wholesale	0.08	0.28
Services	0.36	0.48
Construction	0.12	0.32
Manufacturing & Other	0.22	0.41
Assets (\$000,000)	1.70	7.00
Multiple Locations	0.23	0.42
Owner Managed	0.87	0.34
Unlimited Liability	0.40	0.49
Family Owned	0.84	0.37
Use Trade Credit	0.73	0.45
Competitive	0.49	0.50
Rural	0.27	0.44

Notes: n = 15112

The table shows the unweighted sample means and standard errors for r variables used in the full sample regression.

Duration of the lead bank relationship is limited to the reported age of the firm.

Table 3.15.
Correlates of Relationship Duration for All Relationship Types

Variable	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Year 1993:	-0.65***	-1.10***	-1.10***	-1.10***	-1.09***	-1.05***
Year 1998:	-2.72***	-2.77***	-2.76***	-2.80***	-2.80***	-2.80***
Year 2003:	-0.46***	-0.98***	-0.95***	-0.95***	-0.94***	-0.92***
Firm Age:		0.46***	0.46***	0.46***	0.46***	0.46***
Retail:			0.19	0.06	0.06	0.01
Wholesale:			0.16	0.22	0.22	0.03
Services:			0.05	-0.1	-0.1	-0.05
Construction:			0.23	0.09	0.09	0.05
Assets:				-0.06***	-0.06***	-0.05***
Multiple Locations:				-0.23	-0.22	-0.21
Owner Managed:				0.18	0.17	0.13
Unlimited Liability:				0.54**	0.54***	0.43*
Family Owned:				0.32*	0.32*	0.30*
Use Trade Credit:					0.03	-0.02
Competitive:						-0.12
Rural:						1.24***
Constant:	9.72***	3.61***	3.49***	5.59***	5.42***	5.33***
R-squared:	0.02	0.43	0.43	0.43	0.43	0.43

Notes: n=15112

Categories not included are the 1988 year dummy and manufacturing/other industrial classifications.

All models use sampling weights. Significance levels are based on Huber/White robust standard errors.

***significant at <1% level

**significant at 5% level

*significant at 10% level

Table 3.16.
Sample Means for Age Subsample Regressions

Variable	Firm Age Five Years or Less		Firm Age Greater than Five Years	
	Mean n = 3423	Std. Dev.	Mean n = 11689	Std. Dev.
Lead Duration (years)	2.80	1.39	11.00	9.09
Year 1988	0.24	0.43	0.20	0.40
Year 1993	0.31	0.44	0.27	0.46
Year 1998	0.22	0.43	0.25	0.41
Year 2003	0.28	0.42	0.24	0.45
Firm Age (years)	3.24	1.36	18.71	12.51
Retail	0.26	0.44	0.21	0.41
Wholesale	0.08	0.26	0.09	0.28
Services	0.37	0.48	0.35	0.48
Construction	0.10	0.30	0.12	0.33
Manufacturing & Other	0.19	0.39	0.23	0.42
Assets (\$000,000)	1.13	7.67	1.89	6.71
Multiple Locations	0.18	0.38	0.25	0.43
Owner Managed	0.90	0.30	0.86	0.35
Unlimited Liability	0.45	0.50	0.38	0.49
Family Owned	0.81	0.39	0.84	0.36
Use Trade Credit	0.67	0.47	0.74	0.44
Competitive	0.49	0.50	0.48	0.50
Rural	0.26	0.44	0.27	0.45

Notes: The table shows the unweighted sample means and standard errors for variables used in regression on subsamples defined by the age of the firm.

Duration of the lead bank relationship is limited to the reported age of the firm.

Table 3.17.
Firm Age and Correlates of Relationship Duration

Variable	Firm age <5 yrs n = 3423	Firm age >5 yrs n = 11689
Year 1993	-0.08*	-1.84***
Year 1998	-0.24***	-3.93***
Year 2003	-0.12***	-1.46***
Firm Age	0.79***	0.42***
Retail	0.04	0.25
Wholesale	0.03	0.35
Services	-0.01	-0.03
Construction	-0.05	0.12
Assets	0.0	-0.07***
Multiple Locations	0.03	-0.32*
Owner Managed	-0.01	0.09
Unlimited Liability	-0.05	0.6
Family Owned	0.14***	0.2
Use Trade Credit	0.04	-0.18
Competitive	0.01	-0.19
Rural	0.10**	1.51***
Constant	0.19***	4.66***
R-squared	0.6	0.33

Notes: Categories not included are the year 1988 dummy and the manufacturing/other industrial classifications.

Sampling weights are used. Significance levels are based on Huber/White robust standard errors.

***significant at <1% level

**significant at 5% level

*significant at 10% level

Table 3.18.
Sample Means for Credit/Non Credit Subsample Regressions

Variable	No Credit Mean n = 7527	Std. Dev.	Credit Mean n = 7585	Std. Dev.
Lead Duration (years)	9.10	8.87	9.20	8.61
Year 1988	0.19	0.40	0.22	0.42
Year 1993	0.30	0.46	0.29	0.45
Year 1998	0.24	0.43	0.21	0.41
Year 2003	0.27	0.44	0.28	0.45
Firm Age (years)	14.32	12.20	16.09	13.30
Retail	0.23	0.42	0.21	0.41
Wholesale	0.07	0.25	0.10	0.30
Services	0.42	0.49	0.30	0.46
Construction	0.10	0.30	0.13	0.34
Manufacturing & Other	0.18	0.39	0.26	0.44
Assets (\$000,000)	0.64	3.78	2.79	8.87
Multiple Locations	0.15	0.36	0.32	0.46
Owner Managed	0.89	0.31	0.85	0.36
Unlimited Liability	0.51	0.50	0.29	0.45
Family Owned	0.87	0.33	0.80	0.40
Use Trade Credit	0.64	0.48	0.81	0.40
Competitive	0.50	0.50	0.47	0.50
Rural	0.24	0.42	0.30	0.46

Notes: The table shows the unweighted sample means and standard errors for variables used in regression on subsamples defined the presence or absence of credit in the lead bank relationship.

Duration is limited to the reported age of the firm.

Table 3.19.
Lead Bank Credit Provision and Correlates of Relationship Duration

Variable	No Credit Services in Lead Relationship n = 7527	Lead Relationship Includes Credit Services n = 7585
Year 1993	-0.98***	-1.12***
Year 1998	-2.72***	-2.72***
Year 2003	-0.92***	-0.80***
Firm Age	0.50***	0.40***
Retail	0.2	-0.18
Wholesale	0.64	-0.07
Services	0.12	-0.3
Construction	0.29	-0.09
Assets	-0.07	-0.03
Multiple Locations	0.0	-0.22
Owner Managed	0.35	-0.14
Unlimited Liability	0.28	0.50**
Family Owned	0.02	0.55**
Use Trade Credit	-0.06	0.2
Competitive	-0.2	0.02
Rural	1.17***	1.44***
Constant	2.46***	3.27***
R-squared	0.48	0.37

Notes: Categories not included are the year 1988 dummy and the manufacturing/other industrial classification.

Sampling weights are used. Significance levels are based on Huber/White robust standard errors.

***significant at <1% level

**significant at 5% level

*significant at 10% level

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